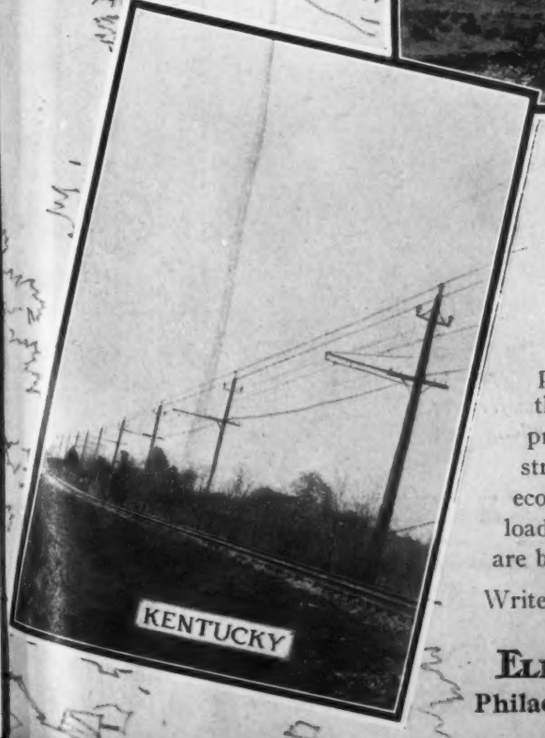
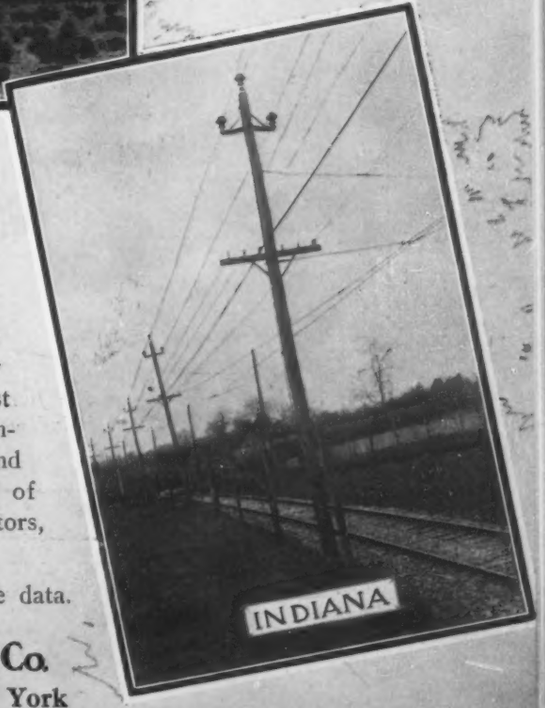
"Talks in the Industry"—An Interview on Public Policy with Guy E. Tripp, Concentration of Control of Public Utilities, and other important contributions

Electrical World

Volume 67, Number 6 McGraw Publishing Co., Inc. New York, February 5, 1916

Engineering Library
PERIODICAL ROOM
RECEIVED
FEB 5 1916
UNIV. OF MICH. LIBRARY





KEYSTONE TRIANGLES

Thousands in use today in various parts of the country prove conclusively that they represent the latest and best practice for single circuit metal arm construction. Exceptional strength, quick and economical installation, even distribution of load with true triangular spacing of conductors, are but a few of their many advantages.

Write for catalog, prints and more complete data.

ELECTRIC SERVICE SUPPLIES CO.

Philadelphia Chicago New York

Weston

PORTABLE
Instrument Transformers

It is a fundamental of Weston policy that every instrument must be capable of accuracy far in excess of its guaranteed percentage. Instrument transformers—and especially the portable models—must necessarily be designed and made with a much greater degree of refinement than is necessary in commercial lighting and power transformers of which only ordinary accuracy is required.

With the determination to make each model of Weston Instruments the most efficient and reliable in its class, we have devoted several years of the most exhaustive analytical study and experimental investigation to the perfecting of Portable Instrument Transformers.

This work has involved the devising of new methods of measurement and the construction of special instruments to ascertain to the highest degree of precision the various factors which affect the performance of Instrument Transformers. The enormous amount of study and experiment has been amply justified by its wonderful result as represented in these Weston Transformers. We can recommend them thoroughly. In every respect they maintain the exacting Weston standard of quality.

Weston Electrical Instrument Co.
13 Weston Ave., Newark, N. J.

New York	Boston	Chicago	Toronto	Berlin
Buffalo	Philadelphia	Detroit	Winnipeg	London
Cleveland	St. Louis	Denver	Montreal	Paris
Cincinnati	Richmond	San Francisco	Vancouver	Petrograd
	Florence	Johannesburg, South Africa		

The full line of new Weston Portable Instrument Transformers, including the three illustrated here, is described in Bulletin 2001.

Electrical World

The consolidation of Electrical World and Engineer and American Electrician.
Published by McGraw Publishing Company, Inc.

Vol. 67 NEW YORK, SATURDAY, FEBRUARY 5, 1916 No. 6

The "Wire-Your-Home Month" Campaign

THE inauguration of a nation-wide "wire-your-home" campaign by the Society for Electrical Development is of particular interest because it is the first time that any effort has been made to synchronize the industry in such a work. The spring house-wiring campaign has come to be an institution in every community blessed with progressive contractors and central stations, but it has been a purely local movement with a local influence. Much greater will be the impulse from a co-operation that will tie in the advertising and selling activities of both manufacturers and jobbers and put the strength of the whole industry into a concerted campaign. It will focus the attention of the entire public simultaneously in all cities, and the movement will gather strength as it travels. There are probably few central stations that have not already given some thought to spring wiring plans, but the society's announcement comes in good time. The wiring of a home is, after all, the very basis of electrical development, and no activity that the Society for Electrical Development could engage in could in truer sense advance its cause or prove a greater service to the industry.

Co-operating for Export Trade

IT is fair to say that the average American manufacturer knows little about foreign trade. The United States broadly has been sufficient unto itself, and American industries, with relatively few exceptions, have developed in a domestic market of free trade between states of our United States. Other nations—Great Britain and Germany, for example—have for years depended largely on their trade with foreign countries and consequently not only have the knowledge of the business which comes with experience but have built up a vast fabric of commercial machinery in financial, exchange, transportation and selling methods with which relatively few concerns in the United States have had direct competition. Temporarily this tremendous foreign merchandising machine has been thrown out of gear by the war, and for the first time in their history manufacturers of the United States have an opportunity to enter foreign markets with relatively little competition. Different phases of this unusual international trade situation were discussed by delegates at the third Foreign Trade Convention at New Orleans on Jan. 27 to 29. A paper on export co-operation, dealing with its necessity and advantage and with legislative enactments relating to it, by M. A. Oudin, manager of the foreign department of the General Electric Company, crystallized a most important side of the discussion. Mr. Oudin showed that one of the most effective instruments for the promotion of foreign trade on the part of England and Germany was co-operation between different business interests. In Germany cartels and syndicates often finance and equip complete installations, dividing the business among the different members. In England the Wire and Cable Association is a powerful co-operative organization for promoting the sale of British wire and cable. Our export statistics indicate that a goodly proportion of our sales of manufactured articles abroad are made by a comparatively few large concerns. These companies have done pioneer work in establishing a market for American-made products. The smaller manufacturers have followed the larger ones into these established markets. In one case a large corporation turned over its credit information to a manufacturers' association without charge. Complete freedom of action for co-operative effort to meet the conditions of foreign trade, however, cannot come without the assurance that such co-operation will not be interpreted by the government as combination in restraint of trade under the Sherman and Clayton acts. Chairman Davies of the Federal Trade Commission stated emphatically at the National Foreign Trade Convention that the Federal Trade Commission realizes this condition and stands ready to aid in the promotion of foreign trade by any means within its power. We are face to face to-day with this anomalous situation, that restrictive legislation enacted in part at least to equalize opportunities for the small manufacturer is now reacting to prevent him from combining with his fellows to enter the foreign market on an equal basis with European competition. The Federal Trade Commission has been investigating the subject of export co-operation. If it will do the unusual thing and show what the American manufacturer can do, and not make it necessary for him to make plans with the fear that what he proposes may be interpreted as illegal, it will give a real impetus to the development of the foreign trade of the United States.

Lighting and Accidents

IT is generally enough agreed that good lighting, indoors or out, tends to prevention of accidents, and some statistical data on the matter are already at hand. In the discussion of industrial lighting recently before the Illuminating Engineering Society in London some additional data and suggestions appear which are worth consideration. In the first place, a four years' record of accidents to persons on railways, obtained from the

Board of Trade returns, gave striking evidence that darkness brings accidents in increasing numbers. In this instance no accidents occurring to trains were considered, but only those which involved simply persons, and these increased by nearly 20 per cent in the mid-winter period. The increase was specially noticeable in connection with accidents to employees. This agrees in the main with the general data obtained from factories, all of which seem to show that the dark seasons and the dark hours are the dangerous ones. Incidentally, one of those discussing the problem intimated there was some evidence at hand to show that the period of transition from natural to artificial lighting was one more than usually productive of accidents. Whether the observed difference is actually due to the transition period, or merely to the fact that this period occurs at dusk, when the total lighting is apt to be a minimum, remains to be seen.

Further, some very pertinent suggestions regarding the lighting of stairways were brought out. Stairways are generally rather badly lighted, since those going up or down them are too often in their own shadows and exposed to over-bright sources of light, if light there be. Well-shaded and well-placed lamps lighting the stairways somewhat obliquely so as to diminish the shadow difficulties would save many a tumble. In this same line one may mention the all too frequent fault of placing street lamps exactly along the line of a crossing so that everyone walking in it away from the light is in dense shadow and cannot in the least see whether the crossing is clear or beset with more or less serious pitfalls. It is quite as bad in going toward the light on a crowded crossing, because of the shadows of the persons ahead. The result is generally more annoying than serious, but the same fault carried out on a long staircase might produce grave accidents. Staircases in factory buildings are usually not well lighted, generally through sheer carelessness. Well-shaded and ample light is the industrial insurance company's best friend. A company engaged in this sort of business ought actively to co-operate in enforcing suitable lighting. The fire underwriters have done an enormous amount of work in improving the safety of electrical installations. They have power to enforce their decrees, and so have those who in dealing with industrial insurance find additional risks produced by inefficient and improper lighting. It is a case where a little forethought will give great assistance in helping to enforce statutory regulations by efficient insurance rules.

Mechanical Problems of Tower Lines

THE manifest purpose of a tower line for overhead power-transmission conductors is to support the latter safely under all reasonable contingencies of wind and weather. This means that the towers must be capable of supporting reasonably balanced loads in the direction of the lines, and a reasonable maximum of lateral wind force, when the conductors are in their worst condition as to deposited snow and sleet. The problems involved in tower design are then not very difficult.

If, however, one or more of the suspended conductors should accidentally break, then the fore-and-aft loads. instead of being nearly balanced, become greatly distorted, tending to pull the towers over in opposite directions away from the break. The towers must then be sufficiently stiff fore and aft to carry this load, or anchor guys must be installed at suitably short intervals to take the stresses; otherwise the line of towers may collapse like a pack of cards. It is in this direction that the problem of mechanical design is most difficult. To make each and every tower sufficiently strong to stand the fore-and-aft stresses occasioned by a complete rupture of all the conductors in an adjacent span frequently involves massive construction and heavy expense. A certain degree of fore-and-aft flexibility in the towers is necessary, in order that the stresses of rupture may be shared in fair proportion by a number of adjacent towers along the line.

Any adequate mechanical design of a tower line therefore involves a proper safeguarding against stresses in accidental rupture, by tower rigidity, tower flexibility and guy reinforcements.

The mechanical problem of the distribution of rupture stresses along a line of adjacent towers is clearly very complicated. Nevertheless, it can be brought under practical control by the use of certain approximations. The subject has been already discussed in the ELECTRICAL WORLD, more than once during the last few years, and certain approximate formulas have been presented to our readers.

A new and extensive investigation of the subject has recently been made by a Japanese engineer, Koga Kato, and published in the *Journal* of the Society of Mechanical Engineers of Tokyo. The paper is divided into three sections. The first deals with the ordinary catenary and parabolic discussion of a span whose ends are level with each other. The second discusses the mathematical theory of a flexible tower. The third treats of the strength of a long column, its own weight being taken into consideration. The mathematical formulas derived are long, but are interesting as throwing light on the engineering theory. The paper forms only the first three-section part of a full discussion of eight sections, so that the publication is at present incomplete.

It is interesting to note that the mechanical design of tower lines, although it usually falls to the lot of electrical engineers, is a matter naturally pertaining more to mechanical and civil engineering than to electrical engineering as ordinarily defined. This is an indication of the tendency of engineering to break down the barriers of distinction between different self-assortments of engineers. It is essential that any engineering student should become acquainted with the fundamental principles underlying all branches; i.e., mechanics, physics, mathematics and chemistry. A student graduating in electrical engineering may find himself assigned, by the course of commercial circumstances, to either mechanical or civil engineering work, and reciprocally; so that specialization should be deferred in the training of engineers to the latest possible stage.

The Phantom Water-Power Trust

THE national government is once more obsessed with a notion that there is a water-power trust. After marshaling and mobilizing its statistics, it finds that eighteen corporations control more than one-half of the total water-power used in public-service operation in the United States, while six corporations control more than one-quarter. Moreover, it is claimed that the data also show a marked tendency toward association or community of interests, particularly between the principal holding companies. We thought it was definitely proved to the Senate committee on public lands in December, 1914, that there is no such thing as a water-power monopoly in the United States, but apparently the ghost will not down. In one breath the government damns monopoly and in the next says: "Monopolization of the supply in any given territory makes possible, through interconnections of stations and through diversification of load, economies of operation that would not be possible for isolated independent stations. Interruptions to service may be lessened, the needs of the customer may be better served and rates may be lower with a single power system than with several. No better service is given and no lower rates charged than in California, where, notwithstanding the considerable municipal developments, 90 per cent of the total primary power is used by public-service corporations, or in Montana, where 89 per cent is owned by two affiliated corporations. Having the ability to give the better service and the lower rate, it only remains for the proper public agency to require it." It is right here that the government's case falls to pieces, because the proper public agency to require it is already provided in the various public service commissions which now regulate electric utilities in all but fifteen states.

As to the charge of monopoly, we admit that monopoly in a measure exists. The whole central-station structure is reared on the foundation of monopoly, because electric-lighting business is essentially monopolistic in character, and not even the government will deny that interconnection between contiguous hydroelectric or other systems offers decided and important engineering advantages. For purely economic reasons the day of little plants and distributing systems and of little companies in the electric-lighting business has gone, just as it has gone in the railroad business. Granted proper encouragement, the electrical industry can build up the country with results as splendid and as far-reaching as those that attended the development of the railroads.

It is evident that the government has gathered statistics and grouped them for the purpose of creating a sensation. Witness, for instance, the chart of interlocking directorates, as hideous in appearance as an ancient Chinese warrior, and just about as formidable. What interlocking directorates have to do with water-power legislation is not so apparent. If they involve infractions of anti-trust laws, there are remedies already at hand for dealing with them. However, it may be pointed out that almost all of the cases cited are not in connection with interstate business, but wholly intrastate, and hence come within the purview of the state and not the federal laws. Besides, what competition can there be between a company distributing electricity in the State of Washington and another in Florida or Iowa that should make it a crime for such companies to have common directors or officials? Who are better qualified to direct the activities of power companies than the men who have devoted their lives to the business and who possess experience in the construction, operation and financing of such properties?

There are other phases of water-power legislation that are clean-cut and ought to give the government more concern than those cited. These do not involve the mooted question of state rights. There is, for instance, and has been for years, a lack of hydroelectric energy at Niagara Falls, N. Y. An international agreement between the United States and Canada specifies exactly how much water may be taken from the Niagara River at that point, and yet, notwithstanding that there is over 4000 cu. ft. of water per second still available on the American side, no permit for developing the power has been granted. Meanwhile, American manufacturers in search of cheap electrical energy have been forced over the border into Canada, where their wants can be supplied. Not only have American industries suffered thereby, but one of New York's chief cities has been handicapped in its development. To remedy this, there is now being erected almost within sight of the mighty cataract at Niagara a mammoth steam station to supply the needs of the city of Buffalo. This is one of the greatest crimes ever sanctioned by a people claiming to want to conserve their natural resources. Might it not be well for the government to remove the beam from its own eye so it can see clearly when it attempts to pull the mote from the eye of an industry endeavoring to develop the country?

The Coming Issues

NEXT week's issue—the second number of the month, which is regularly devoted to station-operating topics—will include an article on the subject of the excitation of synchronous machines, presenting practical data on the excitation requirements of alternators and the behavior of synchronous motors under different conditions of field current at various power-factors. The important subject of boiler-room economies is also to be treated in one of several articles on plant operation to appear in the same issue. In the engineering number of the following week, dated Feb. 19, some of the larger problems of power generation and distribution will be taken up, including recent tendencies and practice in the handling of large loads by underground systems. In this number there will also appear the second of the series of articles on opportunities for the young electrical engineer—a contribution by John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, pointing out what the central-station industry of today has to offer the technical graduate.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Devastating Storms Visit Pacific Coast

Raging winds and heavy rains marked January weather as of the most disastrous kind ever experienced on the Pacific Coast. The worst effects of the storm were felt in California, where small streams swollen with the continued downpour became devastating floods. While in the mountains there are great drifts of snow, only occasional flurries were reported from the valleys.

Southern California was visited on Jan. 16 by a driving rain, and in a short time Lytle Creek and Santa Ana River, outlets for the surplus water, were full to their banks. Continued rain through the next day resulted in an overflow of the banks of the river, together with the cutting of deep and new channels through fertile soil. Houses, animals and débris of all kinds were carried against the abutments of the bridges and the towers used by the power companies to span the stream.

The lines of the Southern Sierras Power Company are carried across the Santa Ana River in the vicinity of Colton, with steel towers firmly set in blocks of concrete 8 ft. by 8 ft. by 20 ft. Service is supplied from the lines to the cities of Riverside, Corona, Perris, San Jacinto, Hemet and Elsinore; also to a thickly settled agricultural district dependent upon electricity for the operation of machinery generally found on the ranch. Buffeted with débris and their foundations undermined, four of the towers crossing the Santa Ana River began to settle and wash out of line. Service, however, was continued without interruption until other river crossings were swept away, when a temporary shut-down of a few hours interrupted service to the towns of Elsinore, San Jacinto and Hemet.

As soon as the crest of the flood was past large crews, under the direction of engineers, began to repair the damage, and in twenty-hours hours by continuous work a 1100-ft. span linked up one of the largest of the gaps in the vicinity of Riverside. A young engineer in the employ of the company swam the torrent at this point, carrying the necessary hand line across, so that block and tackle and wire might follow. In another twenty hours a further gap of 750 ft. was repaired, and service was again delivered from the power company's line at 33,000 volts to the city of Riverside.

Other damage suffered by the Southern Sierras Power Company included the washing out of its transmission system in the vicinity of Whitewater, shutting off all service to the Imperial Valley. A large force rapidly repaired the break, and service was again resumed on this important branch of the company's system on Jan. 21.

Electric-Truck Proposals Called for by Government Departments

Secretary McAdoo has issued a call for specifications and bids for electric and gasoline trucks for the executive and other departments of the United States government at Washington for the fiscal year beginning July 1, 1916. The sizes specified are trucks of 1000 lb., 1500 lb., 2000 lb., 3000 lb., and 6000 lb. rating, and sealed proposals will be received until Monday, March 6, by the general supply committee at Washington. Proposals must be made out on the blanks and data sheets which will be issued by the committee to interested parties upon application.

Lighting Sales Bureau, N. E. L. A., Committee Meeting

Active work on the report of the committee on municipal and highway lighting, Lighting Sales Bureau, N. E. L. A., of which Thomas J. Kelley, Dayton Power & Light Company, is chairman, began with a meeting of the committee in the office of N. H. Boynton at Nela Park, Cleveland, on Jan. 31.

Written reports were received from these committee members: F. D. Shaffer, Public Service Company of Oklahoma, Chickasha, Okla.; S. H. Conkey, General Electric Company, Minneapolis, Minn.; C. M. Masson, Southern California Edison Company, Los Angeles, Cal., and S. N. Clarkson, Union Electric Light & Power Company, St. Louis, Mo. Plans were adopted for the preparation of a report on ways and means for the sale of lighting for all classes of municipal thoroughfares and roads under the jurisdiction of various political divisions, as states, counties and townships. It is the intention of this committee, as expressed by Chairman Kelley, to make its report of as much practical value as possible to central stations seeking business having to do with the lighting of public thoroughfares of all classes. Another meeting of the committee will be held late in February.

Engineers Organize for Preparedness Under United States Army Supervision

In line with President Wilson's plan for national preparedness, and under the direction of Major-General Leonard Wood, U. S. A., representative men of the four national engineering societies have adopted a plan to organize a course of lectures in military engineering and to arouse interest in a tour of field duty at Plattsburg, N. Y., next summer.

The American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers have a membership of approximately 30,000.

Officers of the United States Army, Corps of Engineers, have consented to deliver a series of seven lectures on the following subjects, preparatory to permanent organization, and to assist those who desire to enter the engineering battalion which is to be formed at Plattsburg:

Feb. 14.—"Organization and Duties of Engineers in War, and What Engineers in Civil Life Will Be Called Upon to Do in the Defense of the United States," by Capt. Thomas M. Robins.

Feb. 21.—"The Service of Reconnaissance, Including Surveying, Mapping and Sketching, Photography and Map Production," by Capt. Richard T. Coiner.

Feb. 28.—"Field Fortifications, Sieges and Demolitions," by Capt. Thomas M. Robins.

March 6.—"Seacoast Defenses and Battlefield Illuminations," by Capt. Edward D. Ardery.

March 13.—"The Construction, Maintenance and Repair of Roads, Bridges and Ferries; the Selection and Preparation of Fords," by Capt. Thomas M. Robins.

March 20.—"The Selection, Laying Out and Preparation of Camps and Cantonments; the Service of General Construction, and the Special Services, Including All Public Work of an Engineering Nature Which May Be Required in a Territory Under Military Control," by Capt. Richard T. Coiner.

March 27.—"The Construction, Maintenance and Operation of Railways Under Military Control, and the Construction and Operation of Armored Trains," by Capt. Thomas M. Robins.

The first lecture, by Capt. Thomas M. Robins, will be given in the auditorium of the Engineering Societies Building, New York, at 8 o'clock Monday evening, Feb. 14. Major-General Leonard Wood is expected to be present.

These lectures are free, and all engineers, whether or not members of the above societies, are invited to be present, without any further obligation on their part.

The organization committee in charge of this movement is composed of the following: J. Waldo Smith, chairman; Gano Dunn, chairman Engineering Foundation; E. L. Corthell, president, Charles Warren Hunt, secretary, American Society of Civil Engineers; W. L. Saunders, president, Bradley Stoughton, secretary, American Institute of Mining Engineers; D. S. Jacobus, president, Calvin W. Rice, secretary, American Society of Mechanical Engineers; J. J. Carty, president, F. L. Hutchinson, secretary, American Institute of Electrical Engineers; Charles F. Rand, president United Engineering Society; Richard S. Buck, J. Parke Channing, Alfred Craven, Thomas Crimmins, George Gibbs, Alexander C. Humphreys, John W. Lieb, William Barclay Parsons, George H. Pegram, Robert Ridgway, Merritt H. Smith and W. H. Wiley. J. S. Langthorn, 250 West Fifty-fourth Street, New York City, is secretary.

Washington Interested in Water-Power Prosecutions

Intimation That Investigations Will Follow the Publication of the Report of Secretary of Agriculture to Determine Infractions of Clayton and Sherman Laws

Directors of some of the biggest public-service corporations of the country, especially those connected with electric-light, street-railway and electric-power companies, as well as banks and trust companies, are facing investigation by the Federal Trade Commission, the Interstate Commerce Commission and the Federal Reserve Board, as well as the Department of Justice.

It is said that, according to the report recently sent to the Senate by the Secretary of Agriculture, which declares there is a monopoly in water-powers in the United States, there is the possibility of prosecution of directors and corporations under the Sherman act for combinations in restraint of trade, and under the Clayton act, which forbids interlocking directorates. The report charges that many of the combinations which have been made among the great companies and financial institutions were effected in 1915, after the passage of the Clayton act, approved Oct. 15, 1914, some provisions of which are retroactive.

Information as to the possibility of such investigations was obtained Tuesday, following an inquiry at the offices of the Federal Trade Commission as to the manner in which the report sent to the Senate, which was made by the Forestry Service of the Department of Agriculture, will reach the commission or be looked into by that body. As a result of this inquiry it is understood that the Federal Trade Commission will take cognizance on its own responsibility of the report as soon as it is published. If it is found that directors of electric light or power companies, or the big corporations as such, have made themselves amenable to the provisions of the Clayton act, they will be summoned by the Federal Trade Commission, granted hearings, and told to desist from practices contrary to the law. The Federal Trade Commission files its own complaints and does not wait for complaints to be presented to it. Under the Clayton act it is specifically charged with enforcing the provisions of the Clayton act which do not affect common carriers or banks and trust companies. The Interstate Commerce Commission is charged with enforcing provisions of the act which affect the street railways—common carriers—and the Federal Reserve Board is charged with enforcing provisions of the act which affect banks and trust companies.

The Senate committee on printing, of which Senator Duncan U. Fletcher of Florida is chairman, met Tuesday morning and decided to recommend to Congress that the report be published as a public document. Only brief extracts of it have so far been published. It will cost $21,000 to print the report, which is voluminous and carries many plates and diagrams, but in view of the millions of dollars involved, the conservation legislation as to water-powers before Congress, etc., it is believed by the Senate committee that the expense of $21,000 is more than justifiable.

The Forestry Service is being besieged by hundreds of persons all over the United States—lawyers, bankers, public service corporation officials and others—who have heard of the report and who want copies of it, "to find out where they are at," as one man expressed it.

A rather complete abstract of one section of the report appears in this issue of the ELECTRICAL WORLD.

Section VII of the Clayton act is as follows:

"That no corporation engaged in commerce shall acquire directly or indirectly the whole or any part of the stock or other share capital of another corporation engaged also in commerce where the effect of such acquisition may be to substantially lessen competition between the corporation whose stock is so acquired and the corporation making the acquisition, or to restrain such commerce in any section or community, or tend to create a monopoly of any line of commerce."

Lawyers said that this paragraph of the act forbids corporations to acquire stock under the circumstances mentioned from the date the act was approved, Oct. 15, 1914. The Forestry Service report says some of these acquisitions have been made since then.

Lawyers for water-power companies have raised the question of late years whether the transmission of power made by water companies from one state to another is "commerce," but other lawyers say that inasmuch as the power is bought and sold such transmission or delivery constitutes "commerce."

Bank directors were forbidden by the Clayton act, "from and after two years from the date of the approval of this act," to be directors in other banks having deposits, capital, surplus and undivided profits of more than $5,000,000. So that such bank directors, of whom there are hundreds mentioned in the report by name, must rearrange their affairs by next October. If any investigation based on the Forestry Service report were to be made as to bankers by the Federal Reserve Board, it would probably, it is said, be directed to ascertaining to what extent banks are holding companies for electric-light, railway and water-power companies, etc., and the Interstate Commerce Commission, similarly, it is said, would direct its attention, if it should make an investigation, to recently formed combinations among railway companies.

Concentration of Control of Public Utilities

Government Report to Senate on Water-Power Situation Claims Tendency Toward Community of Interests, Particularly Between Principal Holding Companies

THE special report submitted to the Senate on Jan. 20 by the Secretary of Agriculture presents the results of an investigation of the water-power situation in the United States made by the Forest Service during the last year.

This report was made in response to a Senate resolution of the last Congress which called upon the Secretary of Agriculture to furnish the Senate with all the information in his possession as to the ownership and control of the water-power sites in the United States, showing what proportion of such water-power sites is in private control and by whom owned, and any facts bearing upon the question of the existence of a monopoly in the ownership and control of hydroelectric power in the United States.

In response to this resolution Secretary Houston has transmitted voluminous data in the form of more than 800 large-sized tables and charts, presenting in far greater detail than has ever been attempted before an exhaustive analysis of the general power situation. The inquiry was made thus extensive, the report itself states, "because only by this means can a clear understanding be had of the relation of water-power development to general power development and of the movement toward concentration of control in the electric power industry."

The report states that eighteen corporations control more than one-half of the total water-power used in public-service operations in the United States, while six corporations control more than one-fourth. The character of this control is definite and complete. Further relationships through common directors and principal officers are disclosed and tabulated. These data show, says the report, "a marked tendency toward association or community of interests, particularly between the principal holding companies."

NINETY PER CENT OF ALL POWER ON PACIFIC COAST OWNED BY PUBLIC UTILITIES

"Of all the primary power employed in the electrical industries and in manufactures in 1902," says the report, "11.2 per cent was installed in commercial central stations. This proportion had risen to 23.8 per cent in 1912, more than doubling in the ten years. The movement toward concentration is found in all sections of the United States. For the ten years 1902 to 1912 the rate of concentration was highest in the South Atlantic States, which had three times as great a proportion of primary power in commercial stations in 1912 as in 1902. The extent of concentration was greatest in the Western States. Fifty per cent of all primary power of all kinds in the Mountain States in 1912 was owned by public-service corporations, and 54 per cent in the Pacific States. In California the proportion was three-fourths. To-day, only three years later, public-service corporations own 90 per cent of all the primary power in these two groups of States."

The report was presented in three parts—Part I containing the text of the report, Part II the plates and tables concerning primary power, power generated and financial statistics, and Part III the data on the interrelations of public-service holding companies and in turn the relations they bear to certain financial institutions.

A very full abstract of this last part of the report is given in the following columns:

CONCENTRATION IN CONTROL OF ELECTRIC POWER

There are several lines of evidence which show a continuously increasing tendency in the direction of concentration in the control of the development, distribution and sale of electric power. Each year shows a greater percentage of electric power being produced by commercial central stations—the public-service corporations. Each year also shows a few of the more prominent groups of interests securing control of a larger proportion of the central-station business. Some corporations, like the Utah Securities Corporation, the Montana Power Company and the Pacific Gas & Electric Company, dominate a single compact territory; others, like Stone & Webster, H. M. Byllesby & Company and the Doherty Operating Company, spread their operations widely, controlling smaller groups of operating companies in many distinct territories. Sometimes the character of the control is definite and distinct through actual ownership of properties, or majority holdings of the stock, or direct management of operating companies; sometimes it is indistinct and indefinite through representation on boards of directors. How great a degree of control is exercised in any particular case through mere representation on boards of directors is uncertain. It is scarcely to be supposed, however, that such representation is without influence, even though the degree of influence may be problematical. Again, it will be found that many electric-power corporations, particularly the holding companies, have representation through common directors in certain of the larger banking corporations. Whether this means the exercise of an influence by power corporations over the policies of the banking corporations, or vice versa, or how important such influence may be in any given instance, is indeterminable from any public sources of information. Suffice it to say that did such influence reach to the extent of control it would be of serious public concern. A control of the sources of credit would mean a control of the entire industry, would be the most effective means of stifling competition, and, regardless of how well the industry might be controlled in its service operations by public agencies, would leave the opportunities of engaging in the business and the initiation of new enterprises in the hands of the few.

The Secretary of Agriculture discusses the general concentration of the electric-power business into the hands of public-service corporations, the proportion of control which certain corporations exercise over the development of electric power in the several States, the extension of the operations of certain holding companies into several States and the steps by which they secured control, the relation by common directors which exists between the several holding companies, and the relation through common directors of certain banking corporations to the electric-power holding companies.

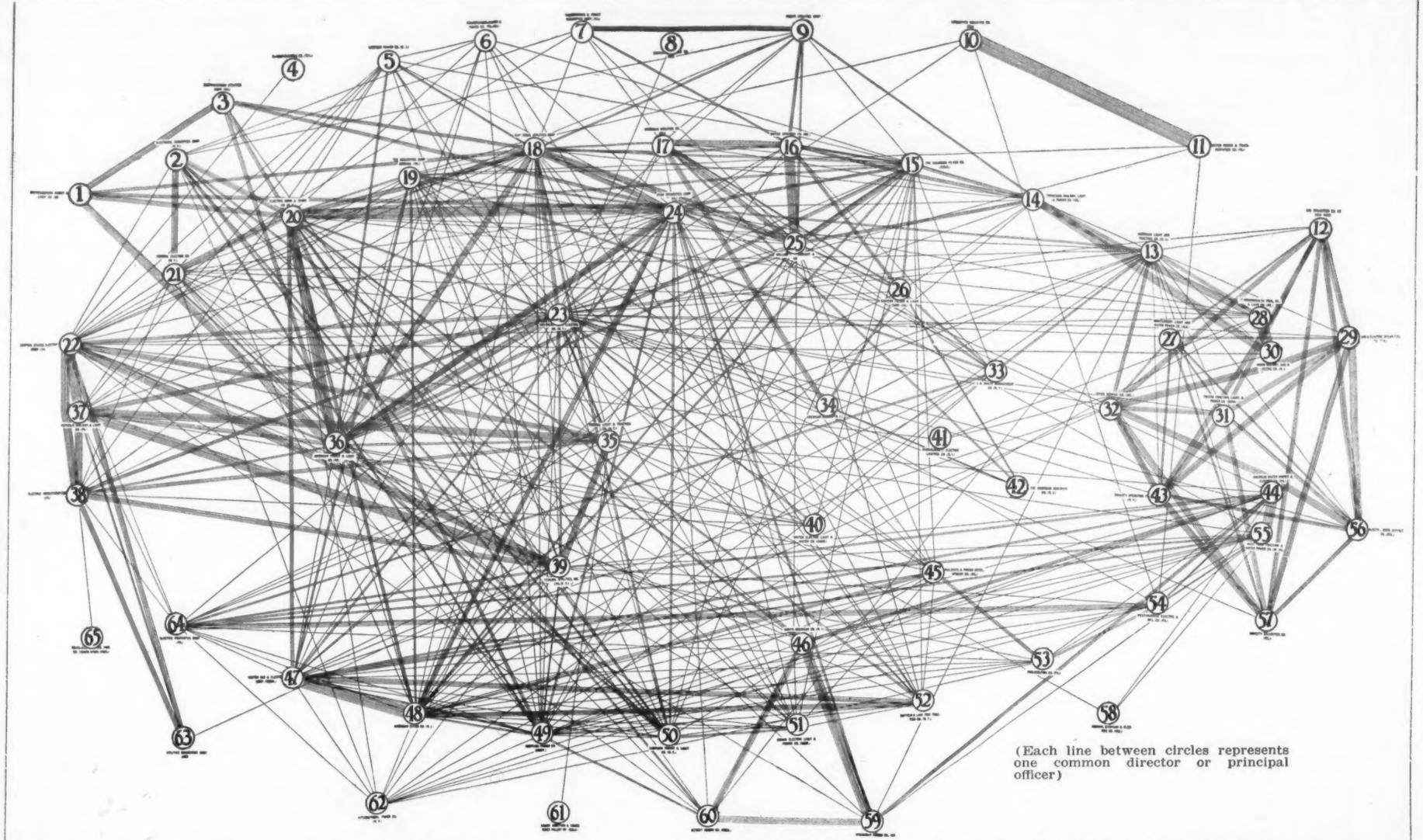
INCREASE IN PROPORTION OF CENTRAL-STATION POWER

The tendency toward concentration of power development into the control of public-utility corporations, he claims, is clearly indicated by the statistics of primary power presented in the reports of the Bureau of the Census for 1902, 1907 and 1912. Of all primary power, steam, water and gas, employed in the electrical industry and in manufactures in 1902 11.2 per cent was installed in commercial central stations. The proportion rose to

TABLE TAKEN FROM REPORT OF SECRETARY OF AGRICULTURE, SHOWING EIGHTY-FIVE PUBLIC-SERVICE CORPORATIONS EACH OF WHICH CONTROLS NOT LESS THAN 30,000 HP. OF PRIMARY POWER

No.	Name of Company	No. of States	No. of Stations	Individual Totals			Cumulative Totals		Individual Percentages		Cumulative Percentages	
				Water-Power	Steam and Gas Power	All Power	Water-Power	All Power	Water-Power	All Power	Water-Power	All Power
1	Stone & Webster	13	62	340,211	189,643	529,854	340,211	529,854	6.36	3.56	6.36	3.56
2	Commonwealth Edison Co. (Ill.)	1	4	0	511,150	511,150	.....	1,041,004	0	3.44	....	7.00
3	Consolidated Gas Co. (N. Y.)	1	8	0	481,895	481,895	.....	1,522,899	0	3.24	....	10.24
4	North American Co	3	30	5,583	420,377	425,960	345,794	1,948,859	0.11	2.86	6.47	13.10
5	H. M. Byllesby & Co	17	53	116,155	160,341	276,496	461,949	2,225,355	2.17	1.86	8.64	14.96
6	E. W. Clark & Co. Management Corporation	4	36	162,330	103,365	265,695	624,279	2,491,050	3.04	1.79	11.68	16.75
7	Pacific Gas & Electric Co. (Cal.)	1	13	152,080	108,540	260,620	776,359	2,751,670	2.84	1.75	14.52	18.50
8	Interborough Metropolitan Co. (N. Y.)	1	2	0	246,500	246,500	.....	2,998,170	0	1.66	....	20.16
9	Public Service Corporation of New Jersey	1	16	0	232,905	232,905	.....	3,231,075	0	1.57	....	21.73
10	Doherty Operating Co	14	43	43,100	180,401	223,501	819,459	3,454,576	0.81	1.50	15.33	23.23
11	Southern Power Co. (S. C., N. C.)	2	9	157,850	47,010	204,860	977,309	3,659,436	2.95	1.38	18.28	24.61
12	Utah Securities Corporation	3	43	171,702	30,374	202,076	1,149,011	3,861,512	3.21	1.36	21.49	25.97
13	Brooklyn Rapid Transit Co. (N. Y.)	1	5	0	198,025	198,025	.....	4,059,537	0	1.33	....	27.30
14	Pacific Light & Power Corporation (Cal.)	1	13	117,950	79,300	197,250	1,266,961	4,256,787	2.21	1.32	23.70	28.62
15	Montana Power Co	1	19	179,700	8,300	188,000	1,446,661	4,444,787	3.36	1.27	27.06	29.89
16	International Paper Co	5	23	156,830	29,945	186,775	1,603,491	4,631,562	2.94	1.25	30.00	31.14
17	United Gas & Electric Corporation of Connecticut	9	17	5,250	181,110	186,360	1,608,741	4,817,922	0.09	1.25	30.09	32.39
18	Commonwealth Power, Railway & Light Co	4	47	70,813	112,160	182,973	1,679,554	5,000,895	1.32	1.24	31.41	33.63
19	The Philadelphia Co. (Penn.)	1	10	0	161,508	161,508	.....	5,162,403	0	1.08	....	34.71
20	Hydroelectric Power Co. of Niagara Falls	1	3	153,000	0	153,000	1,832,554	5,315,403	2.86	1.03	34.27	35.74
21	Edison Electric Illuminating Co. (Mass.)	1	3	0	140,850	140,850	.....	5,456,253	0	0.95	....	36.69
22	Central States Electric Corporation (Ohio)	1	1	0	135,700	135,700	.....	5,591,953	0	0.91	....	37.60
23	Southern California Edison Co	1	11	56,400	79,120	135,520	1,888,954	5,727,473	1.06	0.91	35.33	38.51
24	Georgia Railway & Power Co	1	7	100,400	33,720	134,120	1,989,354	5,861,593	1.88	0.90	37.21	39.41
25	Boston Electric Railways Co. (Mass.)	1	6	0	126,300	126,300	.....	5,987,893	0	0.85	....	40.26
26	Washington Water Power Co	2	5	109,200	16,000	125,200	2,098,554	6,113,093	2.04	0.85	39.25	41.11
27	Pennsylvania Water & Power Co	1	2	118,000	0	118,000	2,216,554	6,231,093	2.21	0.79	41.46	41.90
28	The Niagara Falls Power Co. (N. Y.)	1	2	115,000	0	115,000	2,331,554	6,346,093	2.15	0.77	43.61	42.67
29	Western Power Co. (Cal.)	1	4	73,330	38,670	112,000	2,404,884	6,458,093	1.37	0.76	44.98	43.43
30	American Gas & Electric Co	5	20	0	109,970	109,970	.....	6,568,063	0	0.74	....	44.17
31	Philadelphia Rapid Transit Co	1	5	0	105,730	105,730	.....	6,673,793	0	0.71	....	44.88
32	N. Y., N. H. & H. R. R. Co	3	16	8,050	96,500	104,550	2,412,934	6,778,343	0.15	0.70	45.13	45.58
33	W. S. Barstow & Co., Inc	7	32	13,475	82,545	96,020	2,426,409	6,874,363	0.25	0.65	45.38	46.23
34	N. Y. C. & H. R. R. R. Co	1	4	22,325	70,800	93,125	2,448,734	6,967,488	0.42	0.62	45.80	46.85
35	American Power & Light Co	4	40	22,978	69,221	92,199	2,471,712	7,059,687	0.43	0.62	46.23	47.47
36	Twin City Rapid Transit Co. (Minn.)	1	3	25,000	66,700	91,700	2,496,712	7,151,387	0.47	0.62	46.70	48.09
37	Alabama Traction, Light & Power Co	1	7	72,500	18,920	91,420	2,569,212	7,242,807	1.35	0.61	48.05	48.70
38	United Railways Investment Co. (Cal.)	1	5	65,600	25,330	90,930	2,634,812	7,333,737	1.23	0.61	49.28	49.31
39	Middle West Utilities Co	9	113	16,824	69,890	86,714	2,651,636	7,420,451	0.31	0.59	49.59	49.90
40	Pennsylvania R. R. Co	2	2	0	85,370	85,370	.....	7,505,821	0	0.57	....	50.47
41	New England Power Co. of Maine	2	7	80,700	700	81,400	2,732,336	7,587,221	1.51	0.55	51.10	51.02
42	Lehigh Coal & Navigation Co. (Pa.)	1	4	5,367	70,500	75,867	2,737,703	7,663,088	0.10	0.51	51.20	51.53
43	Kings County Electric Light & Power Co. (N. Y.)	1	3	0	74,670	74,670	.....	7,737,758	0	0.50	....	52.03
44	San Joaquin Light & Power Corporation (Cal.)	1	8	40,150	28,950	69,100	2,777,853	7,806,858	0.75	0.47	51.95	52.50
45	Ohio Traction Co	1	6	0	65,611	65,611	.....	7,872,469	0	0.44	....	52.94
46	Virginia Railway & Power Co	1	4	19,000	46,420	65,420	2,796,853	7,937,889	0.36	0.44	52.31	53.38
47	Illinois Traction Co	3	36	4,415	59,026	63,441	2,801,268	8,001,330	0.08	0.42	52.39	53.80
48	United Railways & Electric Co. of Baltimore	1	4	0	61,875	61,875	.....	8,063,205	0	0.42	....	54.22
49	Northwestern Power Co. (Minn.)	1	2	57,000	4,670	61,670	2,858,268	8,124,875	1.07	0.42	53.46	54.64
50	C. H. Tenney & Co	4	18	10,730	50,728	61,458	2,868,998	8,186,333	0.20	0.41	53.66	55.05
51	Public Service Co. of Northern Illinois	1	13	5,300	55,930	61,230	2,874,298	8,247,563	0.10	0.41	53.76	55.46
52	American Water Works & Electric Co	3	14	0	59,097	59,097	.....	8,306,660	0	0.40	....	55.86
53	Consolidated Gas, Electric Light & Power Co. (Md.)	1	7	1,000	56,710	57,710	2,875,298	8,364,370	0.02	0.39	53.78	56.25
54	Massachusetts Electric Cos	1	13	0	57,575	57,575	.....	8,421,945	0	0.38	....	56.63
55	Pillsbury Flour Mills Co. (Minn.)	1	2	57,500	0	57,500	2,932,798	8,479,445	1.07	0.38	54.85	57.01
56	Washington Railway & Electric Co. (D. C.)	1	1	0	53,800	53,800	.....	8,533,245	0	0.37	....	57.38
57	Kansas City Railway & Light Co. (Mo.)	1	1	0	53,300	53,300	.....	8,586,545	0	0.36	....	57.74
58	Carolina Power & Light Co. (N. C.)	1	9	44,400	7,725	52,125	2,977,198	8,638,670	0.83	0.35	55.68	58.09
59	American Gas Co	5	17	15,525	36,350	51,875	2,992,723	8,690,545	0.29	0.35	55.97	58.44
60	United Light & Railways Co	2	7	500	50,025	50,525	2,993,223	8,741,070	0.01	0.34	55.98	58.78
61	New England Investment Co. (Mass.)	1	4	49,400	0	49,400	3,042,623	8,790,470	0.93	0.33	56.91	59.11
62	Nevada-California Power Co. (Cal.)	1	7	37,750	10,670	48,420	3,080,373	8,838,890	0.70	0.33	57.61	59.44
63	Detroit United Railways	1	9	0	46,986	46,986	.....	8,885,876	0	0.32	....	59.76
64	Colorado Power Co	1	7	41,750	4,870	46,620	3,122,123	8,932,496	0.78	0.31	58.39	60.07
65	J. G. White & Co	4	17	20,880	25,599	46,479	3,143,003	8,978,975	0.39	0.31	58.78	60.38
66	American Public Utilities Co	3	9	13,350	31,895	45,245	3,156,353	9,024,220	0.25	0.30	59.03	60.68
67	American Light & Traction Co	4	5	13,400	31,584	44,984	3,169,753	9,069,204	0.25	0.30	59.28	60.98
68	Louisville Traction Co	1	2	0	44,130	44,130	.....	9,113,334	0	0.30	....	61.28
69	United Gas Improvement Co	4	9	350	43,641	43,991	3,170,103	9,157,325	0.01	0.30	59.29	61.58
70	Chattanooga & Tennessee River Power Co. (Tenn.)	1	1	42,000	0	42,000	3,212,103	9,199,325	0.79	0.28	60.08	61.86
71	National Securities Corporation	2	4	39,350	2,000	41,350	3,251,453	9,240,675	0.73	0.28	60.81	62.14
72	Indianapolis Light & Heat Co	1	1	0	40,900	40,900	.....	9,281,575	0	0.27	....	62.41
73	Niagara, Lockport & Ontario Power Co. (N. Y.)	1	1	40,000	0	40,000	3,291,453	9,321,575	0.75	0.27	61.56	62.68
74	Aluminum Co. of America (N. Y.)	1	2	40,000	0	40,000	3,331,453	9,361,575	0.75	0.27	62.31	62.95
75	Columbia Gas & Electric Co. (Ohio)	1	1	0	38,930	38,930	.....	9,400,505	0	0.26	....	63.21
76	Georgia Light, Power & Railway Co	1	3	33,000	4,750	37,750	3,364,453	9,438,255	0.62	0.26	62.93	63.47
77	Turners Falls Power Co. (Mass.)	1	2	36,900	0	36,900	3,401,353	9,475,155	0.69	0.24	63.62	63.71
78	Pacific Lighting Corporation (Cal.)	1	1	0	34,202	34,202	.....	9,509,357	0	0.23	....	63.94
79	Columbia Railway, Gas & Electric Co. (S. C.)	1	2	26,000	7,330	33,330	3,427,353	9,542,687	0.48	0.23	64.10	64.17
80	Northern Ohio Traction & Light Co	1	2	2,270	31,000	33,270	3,429,623	9,575,957	0.04	0.22	64.14	64.39
81	United Properties Co. (Cal.)	1	6	0	33,025	33,025	.....	9,608,982	0	0.22	....	64.61
82	Federal Light & Traction Co	7	12	0	32,373	32,373	.....	9,641,355	0	0.22	....	64.83
83	Fort Wayne & Northern Indiana Traction Co	1	3	0	32,160	32,160	.....	9,673,515	0	0.22	....	65.05
84	United Illuminating Co. (Conn.)	1	2	0	31,200	31,200	.....	9,704,715	0	0.21	....	65.26
85	General Electric Co. (N. Y.)	1	3	31,000	0	31,000	3,460,023	9,735,715	0.58	0.21	64.72	65.47
86	Union Carbide Co. (Mich.)	1	1	30,800	0	30,800	3,491,423	9,766,515	0.58	0.20	65.30	65.67
87	Cohoes Co. (N. Y.)	1	1	30,000	0	30,000	3,521,423	9,796,515	0.56	0.20	65.86	65.87
	Totals for eighty-seven corporations	48	1042	3,521,423	6,275,092	9,796,515	.....	.....	65.86	65.87	....	....
	Municipal stations	48	1600	231,525	496,984	728,509	3,752,948	10,525,024	4.33	4.90	70.19	70.77
	All other stations	43	4299	1,593,751	2,752,367	4,346,118	5,346,699	14,871,142	29.81	29.23	100.00	100.00
	Grand totals		6941	5,346,699	9,524,443	14,871,142						
	Total manufacturing power included			736,197	172,210	908,407						
	Central stations and electric railways, 1915			4,610,502	9,352,233	13,962,735						
	Central stations and electric railways, 1912			2,942,388	8,251,311	11,193,699						
	Increase 1912 to 1915			1,668,114	1,100,922	2,769,036						
	Per cent of increase			36.2%	11.8%	19.8%						

Note.—All but two of the corporations listed hereon, the International Paper Company (16) and the Union Carbide Company (33), are engaged in public-service operations.



39, Federal Utilities, Inc. (Va.-N. Y.). 38, Electric Investment Corporation (Va.). 37, Republic Railway & Light Co. (Pa.). 23, American Gas & Electric Corporation (N. Y.). 36, American Power & Light Co. (Me.). 22, Central States Electric Corporation (Va.). 35, Federal Light & Traction Co. (N. Y.). 18, Electric Utilities Corporation (Me.). 20, Electric Bond & Share Co. (N. Y.). 24, Utah Securities Corporation (Va.). 21, General Electric Co. (N. Y.). 49, Montana Power Co. (Mont.) 50, Carolina Power & Light Co. (N. C.). 46, North American Co. (N. J.).

RELATIONSHIP THROUGH DIRECTORS OR PRINCIPAL OFFICERS OF FEDERAL UTILITIES, INC., ELECTRIC INVESTMENT CORPORATION, REPUBLIC RAILWAY & LIGHT COMPANY, AMERICAN GAS & ELECTRIC COMPANY, AMERICAN POWER & LIGHT COMPANY, CENTRAL STATES ELECTRIC CORPORATION AND FEDERAL LIGHT & TRACTION COMPANY WITH OTHER HOLDING COMPANIES

17.2 per cent in 1907 and to 23.8 per cent in 1912, more than doubling in the ten years from 1902 to 1912. This movement toward concentration is found in all sections of the United States. The rate of increase in concentration was highest in the South Atlantic States, which had three times as great a proportion of primary power in commercial central stations in 1912 as in 1902. The extent of the concentration is greatest in the Western States. One-half of all primary power of all kinds in the Mountain States in 1912 was owned by public-service corporations, and 54 per cent in the Pacific States. In California the proportion was three-fourths. To-day, only three years later, public service corporations own 90 per cent of all the primary power in those two groups of States. Although the 1915 data are not sufficiently complete in the other sections, particularly concerning power used in manufactures, to give definite percentages, it is probable that in the South Atlantic States the percentage of power controlled by public utility companies is well above 50 per cent as compared with less than 20 per cent in 1912. Wherever marked activity in hydro-electric power development exists, as it has existed in recent years in the Western and Southern States, there especially is found in its highest degree the concentration of ownership by public-service corporations.

This particular tendency toward concentration need by no means be of ill omen. Monopolization of the supply in any given territory makes possible, through interconnections of stations and through diversification of load, economics of operation that would not be possible for isolated independent stations. Interruptions to service may be lessened, the needs of the customer may be better served, and rates may be lower with a single power system than with several. No better service is given and no lower rates are charged than in California, where, notwithstanding the considerable municipal development, 90 per cent of the total primary power is owned by public service corporations, or in Montana, where 89 per cent is owned by two affiliated corporations. Having the ability to give the better service and the lower rates, it only remains for the proper public agency to require it.

EXTENT OF CONTROL BY CERTAIN CORPORATIONS

Control by Ownership of Stock or Properties, or by Lease or Management

From detailed tabulations of companies, stations and installations by states summary tables have been made showing the total water-power, the total steam and gas power, and the total power of all kinds, controlled by the principal corporations in each state, together with individual and cumulative percentages.

In general, there have been included in these summary tables all corporations that own or control more than 1 per cent of the total power in a state. Only that degree of control which is represented by ownership of properties, majority stock ownership, management or lease has been considered. Each table also gives the amount and the percentage of water-power and of total power owned by municipalities, the total installation for the state in 1915 as appearing in the detailed tabulations, and the total installation in central stations and electric railways as reported by the Bureau of the Census for 1912. The data, in general, include only commercial and municipal central stations and street and electric railways. For the Western States, however, it is believed that the data are practically complete for all power. This is true as far as water-powers are concerned in many of the other states, but no attempt has been made to secure complete statistics of steam-power in manufactures in the Central, Eastern or Southern States. The chief purpose of this branch of the investigation has been to determine what proportion of the total power developed by municipalities and by public-service corporations is controlled by a limited number of such corporations. The percentages of control, therefore, as given in the résumé by individual states, have reference, unless otherwise noted, to the proportions controlled by certain corporations and municipalities out of the total power developed by commercial and municipal central stations and by street and electric railways.

(Brief résumés for each state, showing to what extent the movement toward concentration has progressed, will be published in a future issue of the ELECTRICAL WORLD.)

United States.—On page 303 is given a list of eighty-seven corporations each of which, according to the data given, controls not less than 30,000 hp. of primary power. Two companies contained in the list, the International Paper Company and the Union Carbide Company, are engaged in manufacturing. The remaining eighty-five are public-service corporations. These eighty-seven corporations control 3,521,423 water horsepower and 6,275,092 steam and gas horsepower, a total of 9,796,515 hp., or 65.9 per cent of the total listed for the United States. If the two manufacturing concerns are eliminated and the amount of manufacturing power contained in the tables is subtracted from the total, the eighty-five concerns remaining control 68.6 per cent of the total public-service power in the United States. Thirty-five of the eighty-five control one-half of this total; sixteen control one-third, and ten control one-fourth. Of the eighty-five corporations shown in the table, fifty-nine have water-power developments and control 65.9 per cent of the total water-power listed. If the two manufacturing concerns are eliminated from this number and the water-power used in manufacturing is subtracted from the total water-power, the remaining fifty-seven concerns control 72.3 per cent of the total water-power in the United States used in public-service operations. Of these fifty-seven concerns, the following eighteen:

(1) Stone & Webster,
(2) Montana Power Company,
(3) Utah Securities Corporation,
(4) E. W. Clark Company Management Corporation,
(5) Southern Power Company,
(6) Hydraulic Company of Niagara Falls,
(7) Pacific Gas & Electric Company,
(8) Pennsylvania Water & Power Company,
(9) Pacific Light & Power Corporation,
(10) H. M. Byllesby & Company,
(11) The Niagara Falls Power Company,
(12) Washington Water Power Company,
(13) Georgia Railway, Light & Power Company,
(14) New England Power Company of Maine,
(15) Western Power Company,
(16) Alabama Traction, Light & Power Company,
(17) Commonwealth Power, Railway & Light Company, and
(18) United Railways Investment Company,

together control 2,356,521 water horsepower, more than one-half (51.1 per cent) of the total water-power used in public service operations in the United States. Of the eighteen corporations named, the first nine control more than one-third (33.7 per cent) of the total, and the first six more than one-fourth (25.3 per cent).

Stone & Webster, through their management of operating companies, control more water-power and more total power than any other corporation, having under their direct management 340,211 water horsepower and 529,854 total horsepower.

Twenty-nine of the eighty-seven companies listed control operating plants in more than one state. Three of these, H. M. Byllesby & Company, the Doherty Operating Company and Stone & Webster, operate in seventeen,

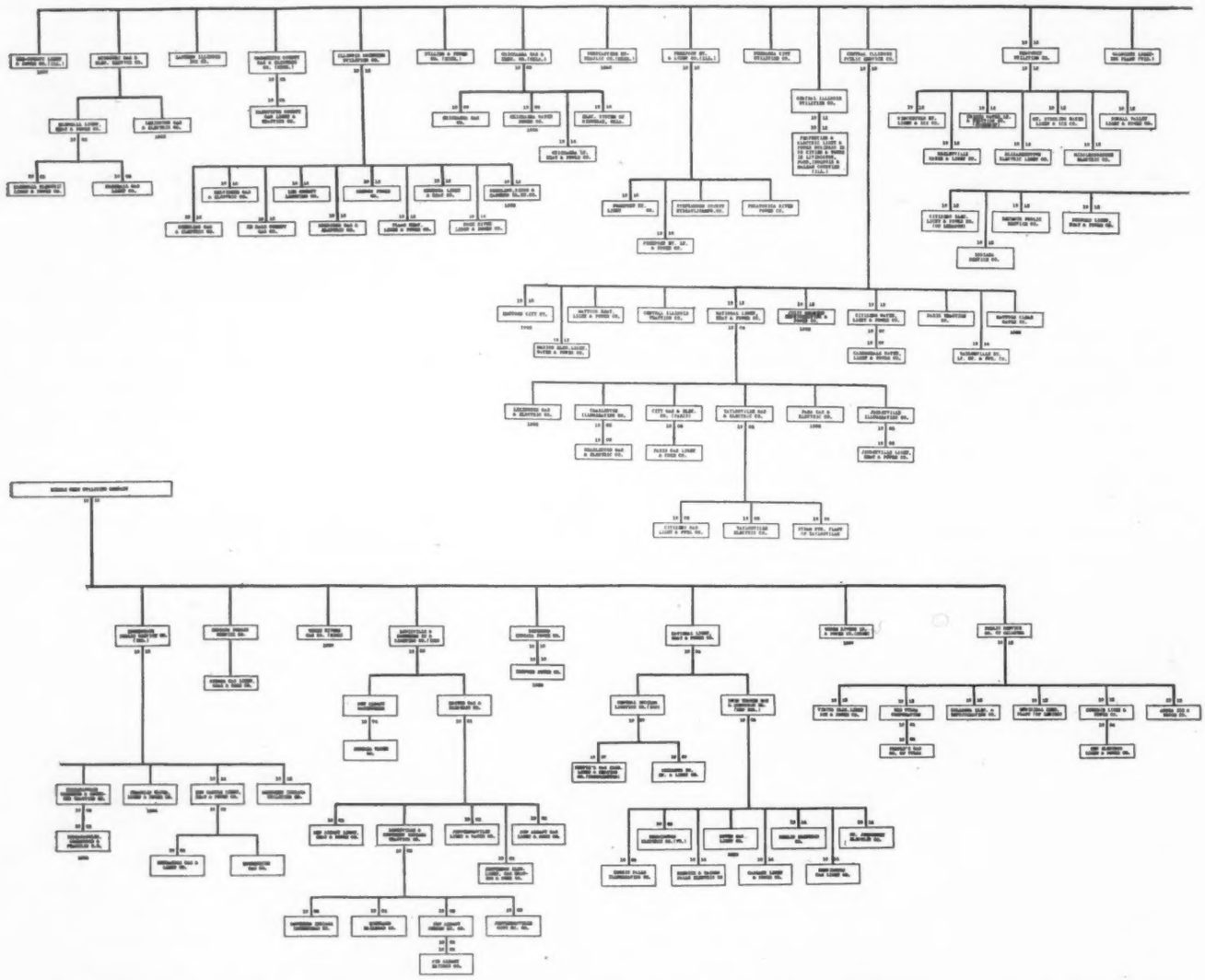
fourteen and thirteen states respectively. The Middle West Utilities Company has the largest number of stations under its control—118 in nine different states.

Attention is again called to the fact that the character of control which has been discussed with reference to the several states is definite and complete. It consists either in actual ownership of properties, in majority stock ownership, in lease or in direct management. The relation between the various operating companies and the controlling or holding companies is best shown upon the organization charts. (One of these is reproduced in part on this page.)

Interrelationships Through Common Directors

A study of the interrelation of the various public-utility electric corporations with each other through common directors or principal officers leads one into an almost endless maze of interconnections. It is extremely difficult to correlate the mass of information and to determine in many instances whether a particular company has the closer association with one or another group of interests. In studying the extent of such interrelationships the chief source of information has been Moody's Manual of Corporations for 1914. The 1915 edition was not available at a sufficiently early date to permit of its use in this line of investigation. The relations shown, therefore, unless otherwise noted, are those existing in 1914. It has not been possible, of course, even had it been desirable, to verify the data as presented in the several corporation manuals. The standing which they have and the presumption that all the information which they contain has been furnished by the corporations the activities of which are described would seem to make further verification unnecessary. The accuracy of the data herein presented is dependent, therefore, upon the accuracy of the sources from which they have been derived.

The report gives in alphabetical order a list of some 1500 corporations engaged in the power business, under each of which is listed, also in alphabetical order, both the power corporations and the banking corporations with which it is affiliated through principal officers or common directors. The list gives also the total number of principal officers and directors in each corporation and the number common to such corporations and every other affiliated corporation. The principal officers considered are the president, vice-president, secretary and treasurer, but such officers have not been counted a second time if they serve also as directors. There is also given in the report a list in alphabetical order of 2172



ORGANIZATION CHART OF MIDDLE WEST UTILITIES COMPANY. THIS COMPANY FURNISHES ONE OR MORE CLASSES OF PUBLIC UTILITY SERVICE TO 331 COMMUNITIES, OF WHICH 218 ARE IN ILLINOIS

(Upper section shows left half of chart and lower section right half)

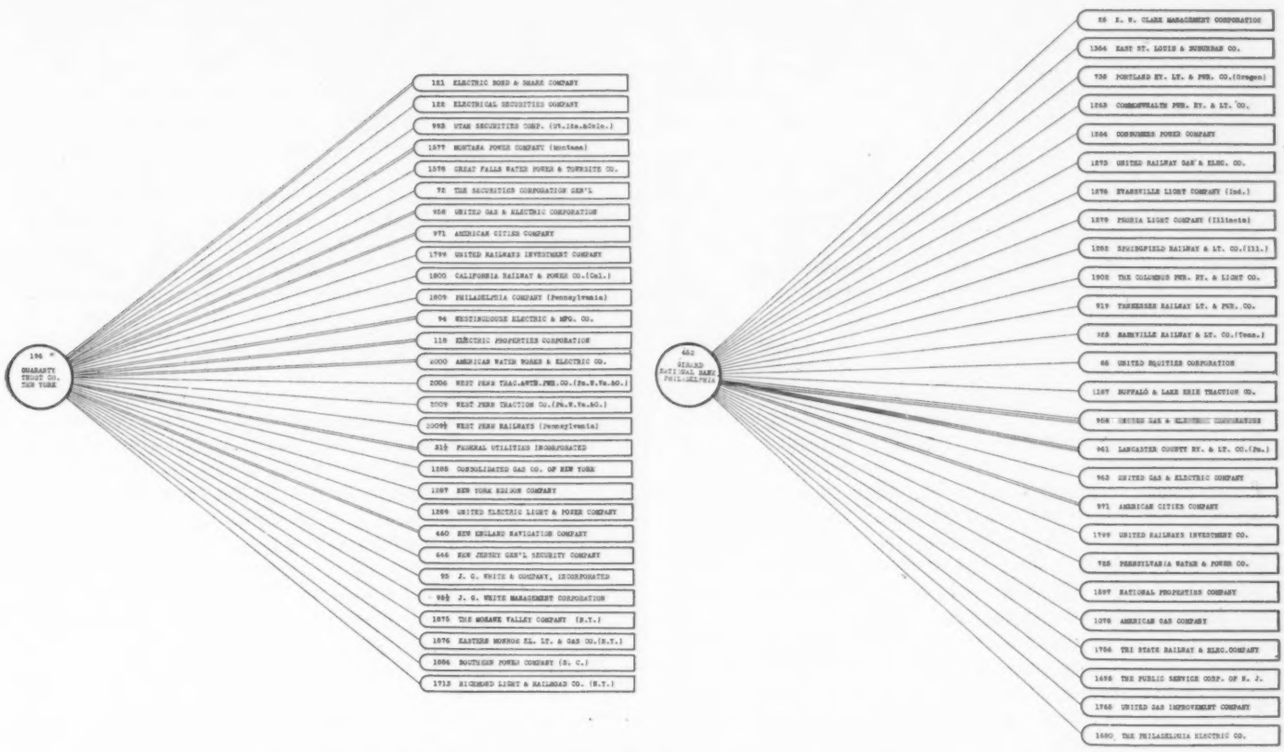
directors and principal officers common to two or more of the corporations studied, and under each director or principal officer a list both of the power corporations and of the banking corporations in which he serves.

In contradistinction to the corporate relationships discussed in preceding pages of this report, where only ownership, lease and management were considered, and where the connection was definite and direct, the interrelationships which are evidenced by common directors are indefinite and the extent of control cannot be quantitatively determined, except in those instances where a majority of the directorate is common to two corporations. Where the preceding data show accomplished control these data show potential control, a marked tendency toward an association or community of interest, particularly between the principal holding companies, that cannot be viewed without concern.

From the general data just described have been prepared three charts. The first chart shows the interrelations, through common directors or principal officers, that exist between 195 of the principal electric-power holding companies. The second chart shows the relationship through common directors between 158 of the electric-power holding corporations shown on Chart 1 and 147 of the banking corporations shown on Chart 3. The third chart shows the interrelation through common directors of 174 banking corporations of New York, Boston, Philadelphia and other cities.

Each of the companies shown upon the first chart is either directly or indirectly connected with every other company shown thereon. From this chart have been prepared diagrams, sixteen in number, which show graphically the relations between certain selected holding companies and other holding companies with which the first appear to have the closest relation. There is a certain amount of duplication of companies between these diagrams, since it has often been found desirable to show the relation which exists between a minor holding company and more than one of the major holding companies.

Each of the sixteen diagrams is preceded by a prefacing sheet explaining the relations shown upon the diagram. Upon the several prefacing sheets is given a table showing the authorized and outstanding stock and the outstanding bonds of the individual concerns listed and the amount of developed water-power, steam and gas power and total power controlled.



RELATIONS BETWEEN BANKING INSTITUTIONS AND ELECTRIC PUBLIC-UTILITY COMPANIES
(Each line indicates one director)

The character of the control over such developed power by the individual companies included in the several groups is direct and complete and is exercised either through ownership of the properties, majority ownership of stock, lease or direct management. What may be the character of the group control, or whether such control actually exists, cannot be determined. The only evidence available shows merely an interrelation between certain interests through common officers or through the medium of common representation upon boards of directors. It is scarcely to be supposed, however, that such representation is devoid of significance and that no influence exists because its amount cannot be quantitatively determined.

The individual public-service companies which make up the sixteen groups control 2,226,000 water horsepower, or 48.3 per cent of total public-service water-power in the United States, as indicated by the special census made for this report. These companies also control 4,160,000 steam horsepower, or 44.5 per cent of the total used in public-service operations, giving a combined total of 6,386,000 hp., or 45 per cent of all public-service power in the United States.

The companies which are given here are the companies the interrelations of which with other companies have been studied, and with which the others appear to be most closely related. As a means of distinguishing the several groups, the names of the principal companies have been applied to the groups in which they appear:

W. S. Barstow & Company.—The individual companies appearing in this group control 34,775 water horsepower and 121,862 steam horsepower, a total of 156,637 horsepower, slightly more than 1 per cent of the total public-service power in the United States in 1915.

William P. Bonbright & Company.—The individual companies in this group together control 885,725 water horsepower, or 19.2 per cent of the total used in public-service operations in the United States, and 655,613 steam horsepower, or 7 per cent of the total of such power in public-service use, making an aggregate of 1,541,338 hp., or 11 per cent of the total in the United States in 1915.

H. M. Byllesby & Company.—The aggregate amount of power controlled by the individual companies shown within this group is 345,692 water horsepower and 469,386 steam horsepower, a total of 815,078 hp., or 7.5 per cent, 5 per cent and 5.8 per cent respectively of the water-power, steam-power and total power in the United States employed in public-service operations.

E. W. Clark & Company Management Corporation.—With the exception of the International Paper Company, all the companies included in this group are public-service corporations. If the amount of power controlled by the International Paper Company is subtracted from the aggregate amount controlled by all the individual corporations, the remainder amounts to 843,049 water horsepower and 1,266,183 steam horsepower, a total of 2,109,232 hp., or 18.3 per cent, 13.5 per cent and 15.1 per cent respectively of the total water-power, steam-power and combined power in the United States operated by public-service corporations.

Doherty Organizations.—Individual concerns in this group control an aggregate of 271,752 water horsepower and 552,417 steam horsepower, a total of 824,169 hp., or 5.9 per cent of the total of each class of power used in public-service operations.

Electric Bond & Share Company.—The relations through common directors or principal officers of the Electric Bond & Share Company to forty-one other corporations is shown. This company is controlled by the General Electric Company through the ownership of the entire common stock. The aggregate amount of public-service power controlled by the individual concerns shown within this group is 928,486 water horsepower and 1,300,370 steam horsepower, a total of 2,228,856 hp., or 20.1 per cent, 13.9 per cent and 16 per cent respectively of the total amount of each class of power employed in public service uses.

Electric Securities Corporation.—The entire common stock of this company also is owned by the General Electric Company. The amount of power controlled by the individual concerns aggregates 497,533 water horsepower and 819,045 steam horsepower, a total of 1,316,578 hp., or 10.8 per cent, 8.8 per cent and 9.4 per cent respectively of the total amounts in the United States in public-service use.

General Electric Company.—The direct connections through common directors or principal officers between the General Electric Company and twenty-nine affiliated corporations is also shown. If there be subtracted from the aggregate controlled by the individual corporations the amount under the control of the International Paper Company, the connection of which with the General Electric Company is shown, the balance remaining will amount to 703,306 water horsepower and 1,298,514 steam horsepower, a total of 2,001,820 hp., or 15.2 per cent, 13.9 per cent and 14.3 per cent of the respective totals for the United States developed for public-service use.

The number of concerns with which the General Electric Company is affiliated through common directors or principal officers, either directly or through the medium of the Electrical Securities Corporation and the Electric Bond & Share Company, both of which the General Electric controls through the ownership of the entire common stock, was too great to be shown upon a single chart in the manner employed in this report. Accordingly separate charts were prepared for the General Electric Company and its two owned subsidiaries. If the three groups are combined without duplication and the amount controlled by the International Paper Company is eliminated, the General Electric groups control 1,290,466 water horsepower and 1,678,657 steam horsepower, a total of 2,978,124 hp., or 28 per cent, 18 per cent and 21.3 per cent respectively of the total public-service power in the several classes in the United States.

Electrical Utilities Company.—The aggregate amount of power controlled by the individual concerns shown within this group is 867,615 water horsepower and 891,224 steam horsepower, a total of 1,758,839 hp., or 18.8 per cent, 9.5 per cent and 12.6 per cent respectively of the totals in each class used in public-service operations.

Federal Utilities, Inc.—The connections through common directors or principal officers of the Federal Utilities, Inc., the Electric Investment Corporation, the Republic Railway & Light Company, American Gas & Electric Company, American Power & Light Company, Central States Electric Corporation and Federal Light & Traction Company with each other and with fifty-eight other concerns are shown. If the amount of power employed in industrial use is eliminated, the balance controlled by the individual concerns appearing on this chart aggregates 914,646 water horsepower and 1,845,496 steam horsepower, a total of 2,760,142 hp., or 19.8 per cent of the total in each class of power employed in public-service operations.

Middle West Utilities Company.—The connections through common directors or principal officers of the Middle West Utilities Company, the Public Service Corporation of Northern Illinois and the United Light & Railways Company with each other and with twenty-five other corporations are shown. The amount of power controlled by the individual companies appearing on this chart aggregates 480,257 water horsepower and 959,685 steam horsepower, a total of 1,439,942 hp., or 10.3 per cent of the totals of the public-service power in each class in the United States.

North American Company.—A plate shows the connections through common directors or principal officers between the North American Company and its subsidiaries, the Detroit Edison Company, the Electric Company of Missouri and the Wisconsin Edison Company, with each other and with fourteen other corporations. The aggregate amount of power controlled by the individual concerns shown upon this chart is 499,365 water horsepower and 748,906 steam horsepower, a total of 1,248,271 hp., or 10.8 per cent, 8 per cent and 8.9 per cent respectively of the totals for the United States in public-service use.

Stone & Webster Management Association.—A plate shows the relations through directors or principal officers of the Stone & Webster Management Association, the Electric Corporation and forty-five other corporations. The individual concerns control an aggregate of 1,353,886 water horsepower and 920,549 steam horsepower, a total of 2,274,435 hp., or 29.4 per cent, 9.8 per cent and 16.3 per cent respectively of the totals of each class employed in public-service operations.

United Equities Corporation.—The aggregate amount of power, after deducting industrial power, controlled by the individual concerns shown within this group is 956,474 water horsepower and 1,355,907 steam horsepower, a total of 2,312,381 hp., or 20.8 per cent, 14.5 per cent and 16.6 per cent respectively of the totals for the United States as developed for public-service use.

Westinghouse Electric & Manufacturing Company.—

A plate shows the relations through common directors and principal officers of the Westinghouse Electric & Manufacturing Company and the Electric Properties Corporation with each other and with thirty-eight other companies. The aggregate public-service power controlled by the individual concerns appearing within this group is 405,705 water horsepower and 1,989,432 steam power, a total of 2,395,137 hp., or 8.8 per cent, 21.3 per cent and 17.2 per cent respectively of the totals for the United States within each class used in public-service operations.

J. G. White & Company, Inc.—The relations between J. G. White & Company, Inc., and the J. G. White Management Corporation and with forty-five other public service corporations is shown. The total power controlled by the individual concerns in this group is 816,683 water horsepower and 1,599,324 steam horsepower, a total of 2,416,007 hp., or 17.7 per cent, 17.1 per cent and 17.3 per cent respectively of the totals of public-service power in the United States.

Relation Between Banking Corporations and Electric-Power Holding Companies

Numerous plates show the relations which exist between certain banking corporations chiefly in New York, Boston and Philadelphia and certain electric-power holding corporations due to the fact that directors in the banking corporations are also directors or principal officers in the electric-power holding companies. No attempt has been made to determine the amount of power under the control of the groups of power corporations with which the several banking corporations are affiliated. The plates merely indicate the extent to which certain banking corporations are interested in electric power corporations, or vice versa.

Control of Undeveloped Water-Power

In connection with the other studies made for this report considerable information was collected concerning the amount of undeveloped power reported to be in the ownership or control of public-service corporations. Time has not been available for verifying the data or for determining whether or to what degree such undeveloped water-powers are claimed by those interests which control the majority of the developed powers. The data show, however, that 120 out of about 1500 public-service corporations the developments of which have been listed in this report claim to own or control a total of 3,683,000 undeveloped water horsepower, or 80 per cent of the total water-power at present developed by public-service corporations. Whether or not these figures are wholly reliable, it may be pertinent to remark that those who lay claim to such extensive ownership or control of undeveloped power sites are hardly in a position to contend that any legislation or lack of legislation, or any administrative policies of the executive departments of the government, should be held responsible for the stagnation in water-power development which they allege exists. The fact—if it be a fact—that a comparatively few corporations hold unused nearly 4,000,000 water horsepower would of itself furnish sufficient explanation.

Ownership or control of undeveloped water-powers, even to the extent claimed by these corporations, is not the most effective method of securing control of the business. If, as is probably the case, the sites owned are those most immediately valuable and best suited for early development, then those who own or control them hold the initial advantage; but the chief factor in control is not so much the ownership of undeveloped power sites as it is the domination of the market. An enterprise once started and with its market established occupies a position of such distinct advantage that it can finance and extend its developments upon terms that a new and untried enterprise cannot secure. The proportion of entirely new enterprises will for this reason grow progressively less. This tendency is being further augmented by the attitude of public utility commissions, which are increasingly manifesting a disposition to favor the extension of established enterprises into new territory rather than the development of such territory by new and competent enterprises. No other state has had such a remarkable water-power development as California within the last few years. Hundreds of thousands of horsepower have been developed and hundreds of millions of dollars have been invested in the electric-power business. Yet a most careful investigation could not discover that a single new public-utility enterprise involving the development of water-power had been started in that state within the last six years. The remarkable development which has taken place consists entirely of extensions to the business of concerns already in the field. Great concentration of power development under present conditions will depend only in a minor degree upon control of undeveloped sources of power; the determining factors will be control of the markets and control of the sources of credit.

Pinchot Elated Over Report

Gifford Pinchot, president of the National Conservation Association, gave out at the Washington office of the association a statement declaring that attempts will be made to "smother" the report made to the Senate by the Secretary of Agriculture, which charges that there is a monopoly of water-power control in the United States, and urging that the Senate committee on printing, to which the report was referred, make it public. In his statement Mr. Pinchot says in part:

"The report on water-power just made to the Senate by the Secretary of Agriculture completely and finally disproves the one and only plausible argument of the water-power grabbers.

"The report shows that where the water-power grabbers have complained most loudly about the retarding of development by the conservation movement, just there, in Washington, Oregon and California, development has gone on until it is now actually in excess of market requirements. What these men are really after is not development but the control of water-powers for speculative purposes and to escape government regulation by acquiring the ownership of water-power sites. This is proved by the fact that a few groups of water-power interests are holding undeveloped at this moment water-power to the amount of 4,000,000 hp. That is to say, the water-power monopolists are holding out of use more than half as much as all the developed water-power in the whole territory of the United States.

"All this does not mean that the water-power laws now in force are ideal. They are not ideal, but they remain defective solely because the repeated efforts of the friends of conservation to get the defects of the present laws remedied were defeated by the water-power men and their friends, more particularly in the Senate of the United States. The latter have steadily insisted on handing over immensely valuable public water-power properties without charge and without regulation, and when they could not do so they would let no bill pass.

"On Jan. 20 Secretary Houston's report was referred to the Senate committee on printing. There is grave danger that its publication will be held up until too late to affect legislation now before Congress."

Talks in the Industry

Guy E. Tripp, Chairman of the Board of the Westinghouse Company, Discusses Public Utilities, Commenting Particularly on the Economical Large Central-Station Unit

By Frederic Nicholas

However serious the collective problems of an industry are for the man whose contact with them is daily and intimate, they wear a different aspect for one who sees them from a little distance. There is no substantial alteration in the problem, but the point of view is changed. A detachment from constant association with the issues brings a new appreciation of the facts. With a different perspective there is another grouping of causes and effects.

Four years ago Guy E. Tripp, who had been actively identified with the development of public utilities, left that branch of the industry to become chairman of the board of directors of the Westinghouse Electric & Manufacturing Company. Early in his career he had been associated with the manufacturing end of the electrical industry. But for fifteen years, until 1912, Mr. Tripp was with Stone & Webster of Boston. At the time of his resignation he was vice-president of the Stone & Webster Management Corporation and the Stone & Webster Engineering Corporation.

For two years prior to his resignation from Stone & Webster Mr. Tripp was in charge of the New York office. His work in the reorganization of the badly wrecked financial affairs of the Metropolitan Street Railway system, which had been intrusted to the firm after numerous failures to perfect a satisfactory readjustment, brought him into close touch with New York bankers. The plan of reorganization which he drafted was adopted. After this work was completed he became chairman of the board of the Westinghouse company.

Mr. Tripp has personal knowledge of public utilities and a deep interest and faith in them, and he still considers their affairs from a viewpoint which is somewhat removed from that of immediate responsibility. He was asked to discuss present conditions for the Electrical World, *dealing with the changes in the public utility situation since he withdrew from his active connection with it. The remarks of Mr. Tripp are confined mainly to public-policy issues.*

"I THINK that the companies, by the gradual improvement in practices which concern the public, have lessened the discouraging public suspicion which they formerly had to face, and that for a few years at least there will be a better understanding with less hostility in the attitude of public officials and agencies toward these properties," said Mr. Tripp.

"The necessity which has confronted central stations of making what appear to the public to be uselessly complicated schedules of rates has caused misunderstandings in some cases. However, I believe that the public service commissions in general are becoming more familiar with the inherent difficulties and peculiarities of the industry, and that the tendency will be toward more tolerant policies of regulation and public control.

"There is no doubt in my mind that responsible executives of the public utilities realize the wisdom, if for no other than business reasons, of doing all that they can to improve their relations with the public. I believe that they are doing their work well."

Mr. Tripp then discussed the principal changes which he observes from the conditions of four years ago. They are the development of large units in central stations and the dangers in the electric street-railway situation. In reply to inquiries he talked of these as follows:

Large Central Stations Economic

"The day of the small central station covering a limited area and serving only a small portion of the possible needs of the community has passed permanently. The merging of small plants into large properties is an economic movement and inevitable. Great central stations serving a wide area and containing installations of large units of machinery which are capable of producing power at costs unheard of a few years ago are the economic successors of the small plants with which the industry began.

"Single generating units of 40,000-hp. rating have been built and are being operated successfully, and the Westinghouse company is designing a unit of 67,000-hp. rating. I have not the figures at hand, but I feel confident that one of these units will produce more electrical power than was used in the entire State of Massachusetts twenty-five years ago.

"The establishment of the large central stations, and the consequent assumption of the entire demand in a large area—street railway, trunk-line railroad, industrial, lighting, residence, etc.—result in a high load-factor which permits very low average rates for service.

Further Centralization Assured

"I believe that in the near future there will be a general linking up of the large central-station developments. To feed into a common system will mean a further extension of the possibilities of electric service with uses now unthought of. Thus far the evolution which is in progress has resulted in combinations and consolidations and holding companies. The economic reasons which underlie this movement assure a further centralization. The clear interests of the public demand that this should be permitted, subject, of course, to fair regulation, so that in the future electric service may become somewhat like the telephone service, where a subscriber anywhere can be connected for the kind of service he requires.

"The result of this will be greater economy in capital investment and a lower interest rate. The investment situation will also be improved by such a development of the industry, because the securities of electrical projects will rest upon a broader basis and the enlarged properties will not be affected by fluctuations in the business conditions of isolated communities. If the present commercial activity should continue for a few years, there will be, of course, an increasing amount of capital for investment which will accentuate the tendency toward low-cost development funds.

Competition for Electric Railways

"The electric street-railway business, which was popularly thought to be an impregnable monopoly owing to the occupation of the streets by tracks, has been found to be vulnerable and open to most serious competition from the jitney service which has sprung up all over the United States.

"In this new situation the street railways have not received proper compensation in the reduction of burdens which were placed upon them by the public on the erroneous assumption that they would be monopolies. The result has been a very large decrease in gross earnings without a corresponding decrease in operating expenses, fixed charges or taxes.

"This seems to me to be a problem which must be solved either by imposing the same conditions on all public carriers that use the streets, or, if there is to be open competition, by giving a free hand to street railways in order that they may reduce service, abandon

unprofitable lines, or increase fares to such extent and in such localities as the management deems wise. All of these privileges are now exercised by the operators of jitneys, and certainly there is no justice in withholding the right from street railways unless they are to receive some compensating protection."

FRANKNESS AND PUBLICITY

Mr. Tripp was asked to suggest some foundation principles to guide central stations in strengthening their public relations. This was his reply:

"The only basic principles which occur to me are frankness and publicity, even though frankness sometimes costs something and publicity is occasionally embarrassing."

National Spring House-Wiring Campaign

Plans for a nation-wide house-wiring campaign this spring—to be known as "wire-your-home month"—were formulated at a meeting of representative manufacturers, central stations and contractors held in the offices of the Society for Electrical Development, Inc., New York, on Monday, and an executive committee was formed to carry on the work. The date designated was the period from March 15 to April 15.

The object of the campaign is to co-ordinate the various individual house-wiring campaigns conducted each year by electrical interests into a general campaign. The facts that not 8 per cent of the homes of this country are wired for electricity and that not 20 per cent of the houses on the existing lines of the central stations have electric service strengthened the committee's belief that if a great campaign drive were made to wire more homes, all interests co-operating, greater results could be obtained than by a series of disconnected campaigns.

The following were appointed as an executive committee to have supervision of the campaign: P. L. Thomson, chairman; T. J. McManis, Elliot Reid, N. H. Boynton, Joseph F. Becker, George Weiderman, E. E. Whitehorne, J. M. Wakeman, H. W. Alexander, A. J. Edgell, J. T. Kelly and C. H. Griffith.

The campaign is to be conducted by the Society for Electrical Development, and while it was recognized that the time is short, the fact that some of the advertising material is about ready for distribution convinced the committee that a short campaign would be sufficient to equip the industry with all material for the big drive and to awaken the public to the advantages of complete electric service. Since house-wiring campaigns are conducted each spring by most manufacturers and central stations, it is planned this year to make a great co-operative campaign, using a standard window display, much of the same advertising material, together with such special individual campaign matter as the manufacturers care to distribute. It is the intention of all interested to boost house wiring rather than to specialize in the sale of their own supplies. A special window display will be sent to the central stations and contractors throughout the country.

A booklet entitled "Successful House-Wiring Plans" will be mailed about Feb. 15. It will contain suggestions for conducting house-wiring campaigns and data on how various central stations and contractors have effectively worked them out. Bulletins of progress containing selling suggestions for household appliances as well as new ideas for house-wiring campaigns will also be issued. The executive committee has urged that a concession by local electrical interests be offered to householders as an inducement to wire their homes this spring.

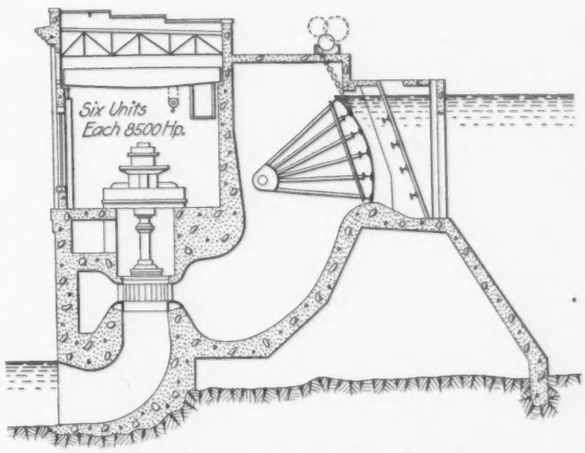
The Commercial Section of the National Electric Light Association and other electrical organizations will cooperate with the society in the movement, and if the "wire-your-home" campaign this year proves as successful as anticipated, it is proposed by leading electrical interests that it be made an annual affair.

Large Open-Flume Development on Chippewa River

Work has been begun by the Wisconsin-Minnesota Light & Power Company on the Chippewa River at Wissota, Wis., 3 miles above Chippewa Falls, on what is said to be the largest open-flume development in the Middle West. This development calls for the investment of over $2,000,000 of new capital. The financial arrangements to provide this sum for construction purposes have already been made. At the point where the dam is to be built on the Chippewa the river runs through a bed underlaid with pre-Cambrian granite, which has been tested to a depth of from 20 ft. to 40 ft. below the water surface. From end to end the dam and the spillway which will be imposed upon this base will be 6100 ft. long. The portion to run out from the slopes of the adjacent hills to the ends of the concrete spillway will be of earth with a concrete core wall running continuously through it and forming a whole with the spillway. The latter will be 900 ft. long, rising from 60 ft. to 80 ft. above the channel, which will be cut into the rock bed of the river to receive it.

The dam itself will stand 60 ft. above the low water on its down-stream side, and is to be built strong enough to withstand the failure at full flood of every dam either built or contemplated up-stream from its location. It is to be composed of 900 ft. of concrete spillway and equipped with thirteen Stanwerke automatic gates each 64 ft. long and 10 ft. 6 in. high. These gates will operate as the control of the flood water.

There will be 225 ft. of concrete power station built into and made part of the dam, besides 300 ft. of concrete dam from the power station to the earth embank-



CROSS-SECTIONAL ELEVATION OF POWER HOUSE

ment on its side of the river. All the rest of the dam will be of earth work, with a concrete core wall anchored in the rock from the edges and being integrally continuous from the dam itself.

From the top of the embankment to its junction with the hillside the earth embankment will have a slope of one to four. On the down-stream side the slope will be two and a half to one. To provide this slope will involve the placing in position of 650,000 cu. yd. of earth, nearly all of which will be done by sluicing. In addition the dam will be composed of 60,000 yd. of reinforced concrete, entailing the consumption of 85,000 barrels of

cement and 800 tons of reinforcing steel. The plant will be equipped with six directly connected turbine-driven generators. These will have a combined rating of 40,000 kw. Later on additional energy will be transmitted to the Wissota switching station at 13,000 volts from Chippewa Falls and will be raised to the line pressure of 120,000 volts.

A satisfactory contract has been entered into for the sale of the major part of the power at the Wissota plant to the Consumers' Power Company of St. Paul and the Minneapolis General Electric Company. It was the prospective revenue from these contracts which made the preliminary financing of the enterprise possible.

The transmission of power to the Twin Cities will necessitate the construction of 74 miles of a double line of steel towers 47 ft. high and spaced 60 ft. apart. One will be built for use in 1917 and the other for service in 1918. It is expected that the construction work on the Wissota development will be completed by Jan. 1, 1917.

Removal of Legal Restrictions Recurring Theme of Export Convention

The removal of legal restrictions now hampering foreign trade development was a recurring theme at the third National Foreign Trade Convention, held in New Orleans last week under the auspices of the National Foreign Trade Council. It was shown that the three chief agencies needed for the extension of our foreign trade—American banks in foreign lands, co-operation between manufacturers and a merchant marine—are each prevented from playing their full part by adverse federal laws.

In the meeting which discussed foreign banking, the handicap imposed by the Federal Reserve act, which prevents member banks from subscribing to the stock of other banks even though formed for operation in foreign lands, was discussed, and the delegates present indicated plainly that they favored an amendment which would remove the restriction. The legislation adversely affecting co-operation between manufacturers who desire to extend their export business was the theme of an able paper by M. A. Oudin, manager of the foreign department of the General Electric Company. He showed that the anti-trust laws do not discriminate between foreign and domestic business in prohibiting co-operation. Finally, Capt. Robert Dollar, the well-known San Francisco ship owner, told graphically how the seamen's law has driven American shipping from the Pacific and how the high operating costs entailed by it prevent the development of a merchant marine.

The sentiment of the delegates was that the restrictions affecting all three necessary features for foreign trade development should be removed.

Aside from these three outstanding features of the convention, the function which a large foreign trade plays in stabilizing domestic industry was repeatedly pointed out. Mr. Oudin, for example, said: "Co-operative foreign efforts would help keep our factories running at 100 per cent capacity." This stabilizing feature of foreign trade was very keenly appreciated.

Frank A. Vanderlip, president of the National City Bank of New York, gave another angle to the importance of foreign trade. He pointed out that we are piling up tremendous gold reserves in this country, while at the same time European gold reserves are being depleted. After the war the foreign countries will direct their attacks on our reserves. The best way to safeguard them is by building a huge foreign credit here, and that can be accomplished only by a large volume of foreign trade. Mr. Vanderlip, as well as other speakers, pointed out that the present is the psychological moment for foreign-trade expansion, not only because of the adverse conditions affecting European nations, but because of the need of preparing ourselves for what depression may come after the conclusion of the world conflict.

Prof. H. C. Emery made a plea for a "bargaining" tariff and pointed out that anti-dumping legislation would be of no avail, for even if European manufacturers should sell over here at their foreign cost plus a reasonable profit, we should not, in many articles, be able to compete. Moreover, he defended dumping as a perfectly legitimate trade practice, pointing out that it has been commonly employed in this country.

Gilbert H. Montague of New York City discussed export trade and the anti-trust laws, proposing amendments which would give relief.

On the conditions here after the close of the war there were diverse views. Alba B. Johnson, president of the Baldwin Locomotive Works, took a pessimistic view. He expects a very severe depression. On the other hand, James A. Farrel, president of the United States Steel Corporation, at a luncheon given him by the New Orleans Association of Commerce during the convention, expressed the opinion that the wave of prosperity in the United States is too powerful to be easily rolled back or resisted. He does not look for a crash in this country at the conclusion of the war, for while Europe will undoubtedly make an effort to re-establish her foreign trade she will find herself handicapped in so many unexpected ways that it will take years to overcome the difficulties.

Other topics discussed at the convention were as follows: "Investment in Central America," by John Clausen, manager of the foreign department of the Crocker National Bank of San Francisco; "How the Smaller Manufacturer May More Largely Share the Benefits of Foreign Trade," by L. S. Smith of the American Laundry Machine Company, Cincinnati, Ohio; "Details of Co-operative Foreign Selling—How Business May Be Fairly Divided, Method of Distribution, Etc.," by H. C. Lewis, general manager of the National Paper & Type Company, New York; "Investment in Latin America," by Edward J. Berwind, president of the Berwind White Coal Company, New York; "Export Trade and the Anti-Trust Laws—The Legal Status To-day and Some Proposals for Relief," by Gilbert H. Montague, New York City, and "Unfair Discrimination Against American Exports," by J. J. Culbertson of the Interstate Cottonseed Crushers' Association. There were also reports from the merchant marine committee and the committee on commercial education for foreign trade.

Dinner to Brooklyn Electrical Men

The tenth annual dinner given to the electrical men of Brooklyn by the Edison Electric Illuminating Company of Brooklyn was held in that borough Wednesday. About 400 electrical contractors were present. The list of speakers included T. I. Jones, general sales agent of the company, who acted as toastmaster; W. F. Wells, vice-president and general manager, who spoke on the company and also on preparedness; Louis Kalischer, past-president of the Kilowatt Club, who represented the electrical contractors; Lewis H. Pounds, president of the borough of Brooklyn; William Hayward, Public Service Commissioner, First District, New York; A. B. Fry, consulting engineer of the Department of Water Supply, Gas & Electricity, and Frank W. Smith, vice-president of the United Electric Light & Power Company of New York.

A Compact Alternating-Current City Substation

The New Forty-fifth Street Substation of the United Electric Light & Power Company, New York City, Has an Ultimate Rating of About 1 Kva. per 10 Cu. Ft. of Volume

OWING to the growth of alternating-current service in the upper business and residential section of New York City, the United Electric Light & Power Company has built a new substation at 354 West Forty-fifth Street, one of the chief features of which is the unusually high ultimate rating per unit of cubical contents and land area. Space is provided for 12,500 kva. of equipment in a building 25 ft. wide by 100 ft. long by about 57 ft. above the basement floor. This compact arrangement was required because of the high land value. Other points of interest about the station are the provisions which were made to facilitate rapid installation of equipment and to minimize the cost thereof, the connections of equipment which permit continuing service even when some piece of apparatus becomes inoperative, the relay control for preventing injury to equipment in case of trouble, the methods of minimizing vibration, the construction which affords convenient access to all wiring and apparatus, and the method of ventilation that has been employed.

Aside from representing tangibly the United company's idea of a correctly equipped alternating-current substation, the building has been designed architecturally with the interest and welfare of the neighborhood in view, it being in a residential section, and in this respect it adds to the appearance of the neighborhood.

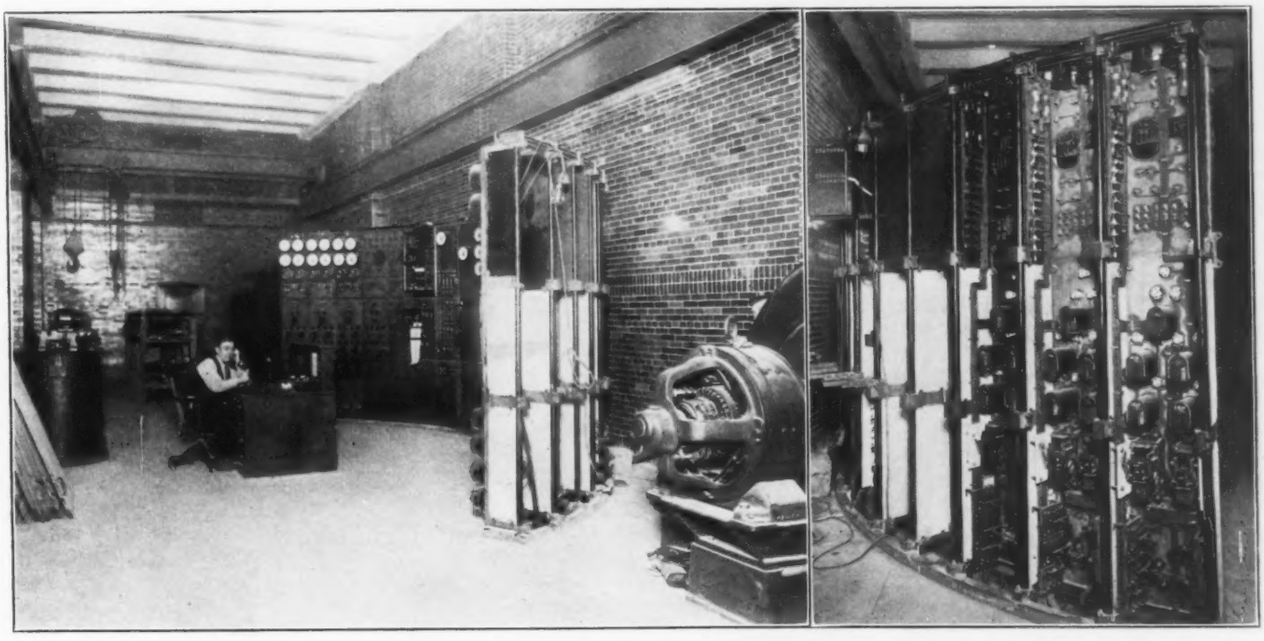
Despite delay on the part of the building contractor, the United company installed the electrical equipment and put it in service in record time. The pouring of concrete for bus and switch compartments was commenced Sept. 2, in advance of the completion of the building, and only six weeks later apparatus had been installed and connected and everything was in readiness to carry a load.

High-Tension Feeder Arrangement to Insure Continuity of Service

The substation receives 7500-volt, three-phase alternating-current energy from the United company's 201st Street generating station directly, and also indirectly through the Elizabeth Street substation, over several sets of cables which are carried through widely separated duct lines. Continuity of service is further insured by terminating the feeders in four separate manholes outside the substation. With these arrangements a burn-out in one cable cannot cripple the entire substation.

Like other substations of the United company, this station distributes energy to a two-phase, three-wire system. Lighting loads are connected across the outside wires, connection to the third wire being made only when two-phase energy must be supplied. The unbalancing of the load on the generating station bus caused by this system of distribution is compensated for at the generating station by connecting the feeders to one station with busbars *A*, *B* and *C*, those to another substation with *B*, *C* and *A*, to another with *C*, *A* and *B*, and so on.

In the wiring diagram (Fig. 6), showing the connection of equipment, it can be seen that any incoming-tension feeder, including the tie, may be connected with



FIGS. 1 AND 2—GENERAL VIEW OF OPERATING ROOM AND REAR OF CURVED SWITCHBOARD

Some of the circuit-breaker-operating mechanisms require too large a current to be handled by ordinary barrel-type switch controllers since the air-gap between contacts is not sufficient to break the arc. On such switches Palmer magnet-type wide-air-gap switches are employed. These are mounted on the back of the switchboard just below the relays controlling them. Special relays are provided for automatically changing the station lighting circuits from alternating-current to direct-current supply in case the former is interrupted. Hinged to the panel back of the totalizing graphic meter is a resistance and terminal box which may be swung out where it will be accessible when tests are being conducted. Stops are provided to prevent the box striking contacts or wiring on the board. This arrangement makes the numerous connections accessible without incurring the drawback that is entailed by the sacrifice of valuable space.

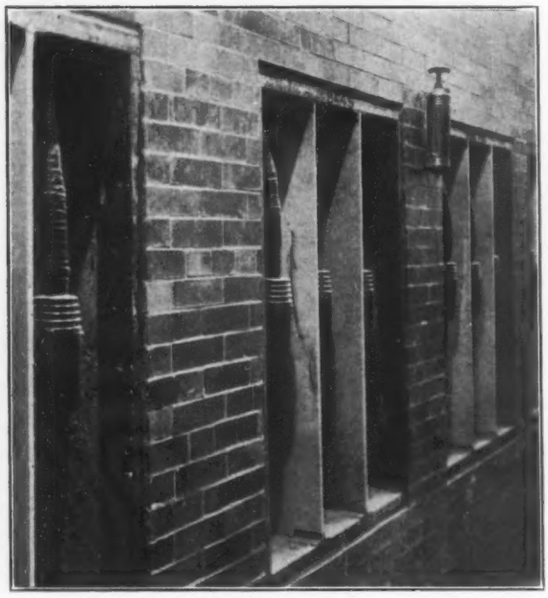


FIG. 3—WALL PULL BOXES IN WHICH VERTICAL RISERS ARE SUPPORTED

any of the transformers, and that all of the transformers may be operated in parallel or independently of each other. Ordinarily, however, each transformer is operated independently of all others. To convert from three-phase, 7500-volt, to two-phase, 3000-volt, for distribution, three T-connected air-cooled transformer sets are employed. Each set consists of a main transformer and a teaser unit placed next to each other. The former are rated at 2000 kva., 7500/4100 volts, and the teasers at 500 kva., 6500/2100 volts. The transformers were selected so that the iron and copper losses will balance the interest on investment, or, in other words, so that the sum of the interest and the value of the power lost will be a minimum under existing load conditions.

The primaries of the main units are connected across one phase of the incoming three-phase line and the secondaries across the outside wires of the two-phase, three-wire system. Between the remaining wires of the primary and secondary systems and the mid-taps of the corresponding main-unit windings are connected the teasers. With these connections the teasers are required to carry energy only when two-phase loads are connected with the secondary system.

Switching facilities permit connecting the transformer secondaries with either of two 3000-volt busbars, each of which is divided into four sections. Under ordinary conditions each unit is connected with its corresponding section of bus No. 1, and then to its individual regulator and the corresponding outgoing feeders. In case any regulator becomes inoperative, however, it may be isolated by oil switches, and the feeders normally connected with it may be fed directly from bus No. 1 without any regulator in circuit or joined with bus No. 2, the voltage of which may be regulated by the spare regulator through the low-tension bus tie.

SYNCHRONOUS CONDENSERS FOR BALANCING TWO-PHASE LOAD AND IMPROVING POWER-FACTOR

To balance the load on the two-phase system and improve the power-factor one 1000-kva. synchronous condenser has been installed and provision made for another of the same rating, which will be installed when required. The condenser is connected directly with bus No. 1, but may be joined with bus No. 2 through the low-tension bus tie. Automatic starting equipment is provided so that the synchronous condenser may be started by its exciter operating as a direct-current motor. When synchronous speed has been obtained, the motor may be connected so as to perform its normal function of exciting the field. Direct current for starting the synchronous condenser as well as for exciting it in emergencies is furnished by a motor-generator set. The condensers are completely inclosed and self-ventilating.

It may be pointed out that the motor-generator and the synchronous-condenser exciter, as well as the one which will be installed later, are each capable of exciting two condensers on peak load. Consequently, when both condensers are in operation, the motor-generator may be stopped, one exciter connected to a direct-current bus supplying all station switching and switchboard-lighting energy, and the other exciter employed to excite both condensers.

Ten Westinghouse voltage regulators capable of bucking or boosting the voltage 10 per cent are installed at present, and space is provided for as many more. The operating mechanisms are mounted so that they do not extend beyond the circumference of the regulator case, thereby affording a neat appearance and requiring the minimum amount of floor space. All of the regulator terminal conductors, including feeders and motor circuits, emerge from the bottom of the regulators, where they are connected with cables leading to other parts of the station on special terminal blocks supported just below the basement ceiling.

Although the substation receives energy at only 7500 volts pressure at present, the equipment has been designed for 15,000 volts in anticipation of changing to

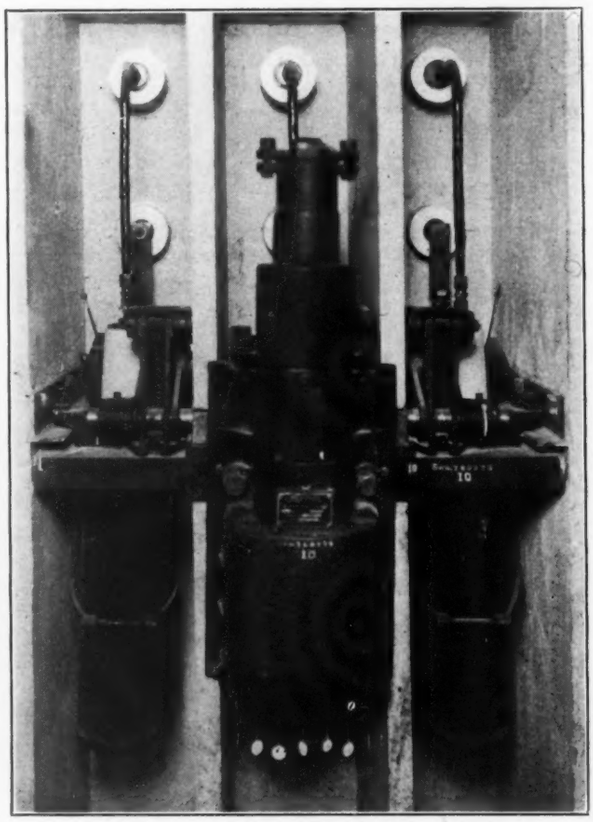


FIG. 4—WAY OF MOUNTING MODIFIED STANDARD OIL SWITCH

The operating mechanism, which is screwed to the front of the oil-switch frame, is locked automatically in the open and closed positions by a ball lock. When either opening or closing coil is energized, a small magnet unlocks the mechanism, allowing the switch to operate, after which the ball drops back into place. Provision is made so that the mechanism may be unlocked manually when it is necessary to operate the switch by hand. The oil switch was developed by the engineering department of the United Electric Light & Power Company and is now manufactured by the Westinghouse Electric & Manufacturing Company.

that pressure when the ultimate installation of 12,500 kva. has been made. The cables enter and leave the building through 4-in. terra-cotta ducts. Inside the station the cables are carried through fiber conduits, which have been laid out with long radius bends to prevent injury to cable and to facilitate replacement of conductors whenever it becomes necessary. The ease of replacement has been further enhanced by installing the cables in short sections joined by Franklin pot-heads. These are supported on brackets to carry the weight of the risers. Access to joints is provided by pull boxes situated at convenient places in the walls and floors. The pot-heads employed permitted considerably quicker jointing than is the case where sweated joints are used. Dossert connectors, many of which were designed specially for this station, are used extensively, notably in the high-tension and low-tension busbars and branches. The 7500-volt bus is made of ¾-in. round copper rods, and the 3000-volt busbars of ⅝-in. round copper stock.

BUSBAR AND SWITCH COMPARTMENTS

The busbar and switch compartments consist of 2½:1 concrete, which was poured in place, the vertical barriers being formed first and the horizontal shelves after the former had set. Steel insulator-pin anchors were cast in the compartment walls to simplify supporting the busbars, voltage-transformer fuses, etc. By doing so it was necessary only to screw the insulator studs in place to mount them. Holes for insulating bushings were made by attaching tapered plugs to the forms before pouring the concrete. When these were removed the bushings were grouted in place. The barriers between disconnecting switches are 1½ in., while those on each side of the oil switches are 3½ in. Thin asbestos boards set in steel frames with handles are employed to inclose the compartments. Besides giving a neat appearance, the panels are light and consequently easily handled by the attendant.

TYPES OF OIL SWITCHES AND METHOD OF MOUNTING

Except in the incoming feeders and high-tension tie, where type C oil switches are employed, all oil switches

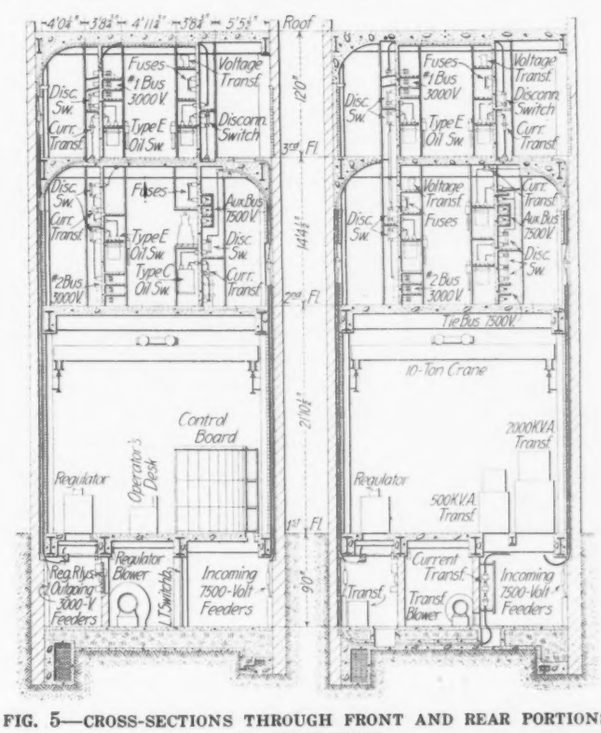


FIG. 5—CROSS-SECTIONS THROUGH FRONT AND REAR PORTIONS OF SUBSTATION

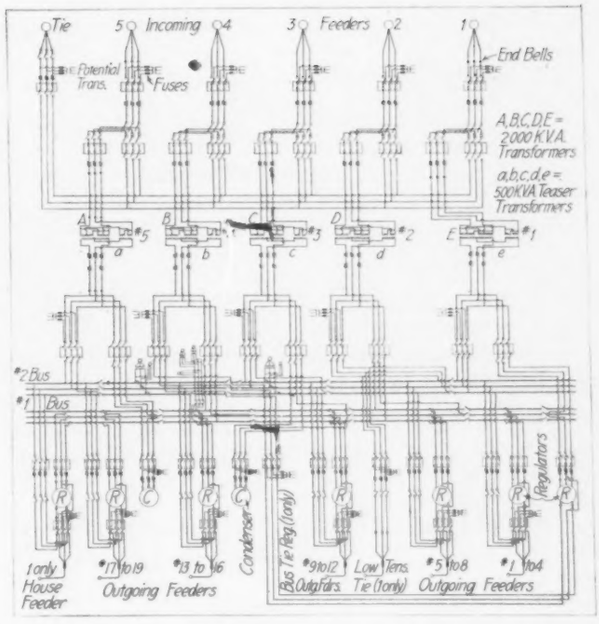


FIG. 6—WIRING AND SWITCHING ARRANGEMENTS WHICH PERMIT INDEPENDENT OR PARALLEL OPERATION OF UNITS

are of the modified Westinghouse type E design, embodying new details of construction. The chief feature of the new switch is the attaching of all oil pots and the switch-operating mechanism to a single frame, which permits installation of the assembled unit and eliminates the necessity of leveling each switch pot separately and lining up shafts. Each set of switches may be lifted as a unit, slid into a compartment, and hung on two angle irons previously bolted to the compartment walls. Set screws permit leveling the oil switch. Attached to the frame and also to the top and bottom of the compartments between each pole are sheet-steel channels, which serve to hold Alberene stone barriers. This arrangement makes it possible readily to remove the barriers at any time without disturbing any part of the circuit-breaker.

RELAY CONTROL

Relays are provided for automatically opening the circuit-breakers on both the 7500-volt and 3000-volt sides of the transformer banks under overloads of a definite duration. They are also differentially connected so that in case of trouble within the transformer the bank will be disconnected from both sides. This automatic feature is provided by Westinghouse type CO and type C relays in the incoming feeder circuits and type CO relays connected differentially with each side of the transformer bank as shown in Fig. 8. The relays connected with the incoming feeders operate an auxiliary relay which acts on the trip coil of the incoming feeder only. The differentially connected relays, however, act on a master relay which opens the trip coils of all oil switches between the incoming feeder and the No. 1 and No. 2 3000-volt busbars.

SOME FEATURES OF THE SWITCHBOARD CONSTRUCTION

The switchboard panels are arranged in the arc of a circle with the operator's desk approximately at the center. The board is supported on 8-in., 11¼-lb., and 4-in., 5¼-lb. channels. To prevent the congestion usually caused by control wiring on the back of panels, asbestos boards have been attached radially to the back of the switchboard between each panel to serve as fuse and terminal boards for the control wires, which are grouped in cables so that they will occupy less space.

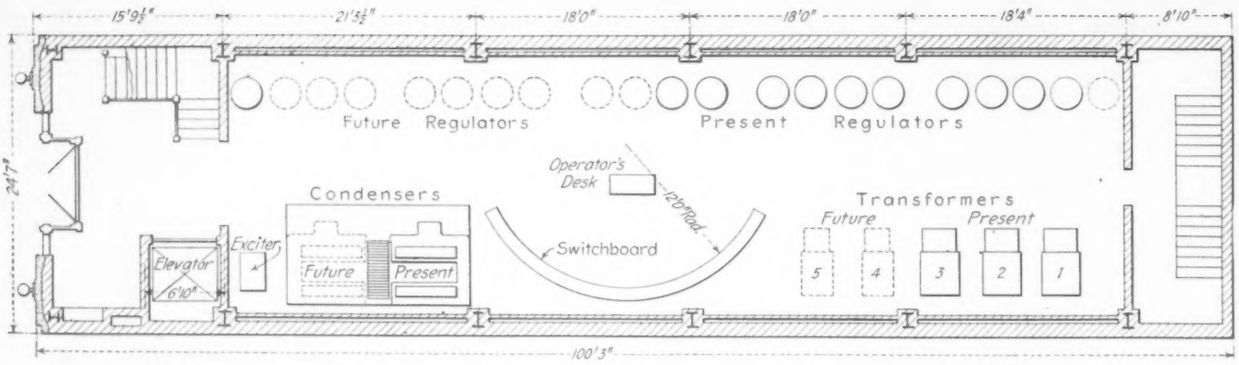


FIG. 7—ARRANGEMENT OF TRANSFORMERS, VOLTAGE REGULATORS AND SYNCHRONOUS CONDENSERS

Another point of interest on the switchboard is the wiring of the switch controllers, which compels an alarm bell to ring when an oil switch opens automatically until the controller handle is turned to the opening or closing position. With this arrangement it is impossible for the operator to stop the alarm bell without first operating the switch controller. As shown in Fig. 1, all relays are mounted on the switchboard. Relays involving a time element are of the spring-retained induction type.

In the basement below the switchboard is a room in which all connections between the switchboard and control wiring are made. Each terminal is numbered so that it may be readily identified. Openings have been left in the ceiling at the base of the switchboard above so that men working there may talk directly with others in the terminal-rack compartment. This arrangement makes every wire accessible for inserting instruments for test without disturbing any of the permanent wiring.

Regulator relays and terminals have been arranged so that no contacts are exposed, though they remain accessible. The relays and auxiliaries are attached to the wall of the compartment where the regulator motor terminals emerge. The wires connected with the relays pass through the wall to a fuse and terminal compartment on the opposite side.

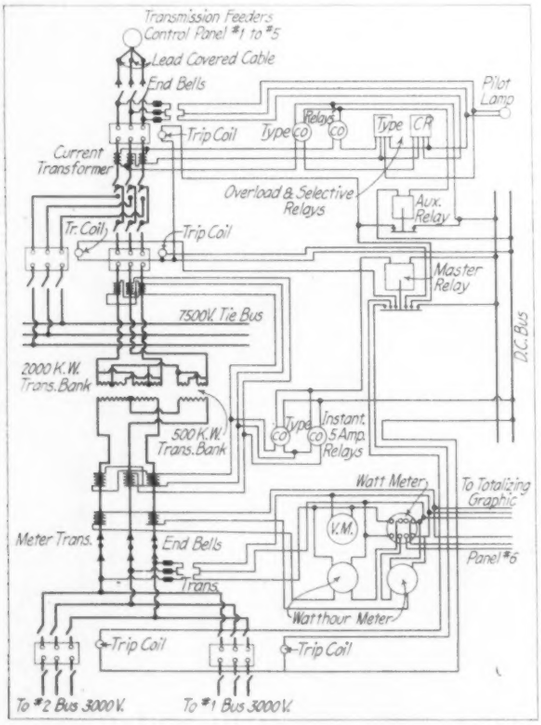


FIG. 8—RELAY-CONTROL CIRCUITS

VIBRATION MINIMIZED BY SPECIAL SUPPORTS FOR MACHINES

Special precautions were taken in designing this substation to minimize vibration, which usually exists where moving machinery or apparatus subjected to magnetic pulsations is employed. Accordingly, the synchronous condensers have been supported on island foundations extending down to bed-rock and separated from the rest of the building by an air-gap packed with felt. Between the floor and the voltage regulators and transformers are cushions composed of a 0.5-in. layer of cork next to the floor, covered with a 0.25-in. steel gasket, a 0.75-in. layer of cork, another steel gasket, and a third layer of cork 1 in. thick. Any vibration that may be transmitted to the substation walls is prevented from reaching adjoining buildings by a 2.5-in. clear space between them.

VENTILATING SYSTEM

As the substation is without windows, except on the front, special arrangements have been made so that all parts of the building shall be thoroughly and well ventilated at all times. Air is taken in through the rear penthouse and drawn through the stair-well to the basement, where it is passed through a 30,000-cu. ft. Metropolitan air washer into a separate passage. Here it is taken by the transformer and regulator blowers and forced up through the apparatus to the first floor. The discharge path is up the front stair-well and out of the front penthouse on the roof. With this arrangement the doors on the several floors can be opened and closed so that the air may be circulated within the building or taken from the outside.

Each transformer is equipped with its individual motor-driven blower, which is electrically connected with an auxiliary winding on the transformer so that the motor starts automatically when the transformer is energized. In case any fan becomes inoperative its corresponding transformer may be ventilated by the other blowers by opening the doors normally separating the compartments under the transformers. Motor-driven blowers have also been provided for ventilating the voltage regulators, but these are served in common rather than individually.

MISCELLANEOUS ELECTRICAL APPARATUS

No heating apparatus has been installed in the station, since it is expected that the electrical apparatus will radiate sufficient heat to make the building comfortable for the attendants. In the absence of a heating plant, "Geyser" instantaneous electric water heaters were installed in the lavatory and over the janitor's slop sink in the basement.

With the exception of the magnet switches in the oil-switch circuits, all of the electrical apparatus in the station was furnished by the Westinghouse Electric & Manufacturing Company.

The History and Purpose of Concentric Wiring

Abstract of an Address by R. S. Hale of the Edison Electric Illuminating Company of Boston Before the Western Association of Electrical Inspectors, Chicago, Jan. 25

IN one sense the subject of concentric wiring is of very limited scope, but in another sense it includes not only concentric wiring itself but many of the problems of grounding. This naturally brings in the matter of the solid neutral, and from these topics the discussion might be extended to cover the whole subject of making wiring better, safer and cheaper than is now permitted under the code.

At one time the code absolutely forbade the grounding of either side of a circuit or of the neutral. The code has been much improved by changing it so as to make grounding obligatory, but although this improvement has been made, yet various other code rules have not been changed. These other rules were good and sound when grounding was prohibited, but are worded so that they prevent our making the wiring on grounded systems as good and safe as it might be made.

THE SMALL USERS OF ELECTRICITY HERE AND ABROAD

The concentric-wiring movement began with some visits made by various central-station people and others to Europe. We found that while on the whole Europe was far behind America, yet in a few places, of which Strasburg and Milan were the chief but not the only ones, Europe was far ahead of us. In proportion to the population, they had a great many more customers, chiefly small ones, using electricity than have even some of the newest cities of the West. If Boston were as well developed as Strasburg, it would have more than twice its present number of customers, New York would have five times as many, and Chicago would have nearly twice as many as it has now.

We then inquired why this condition should exist.

It was not due to the price of electricity, because the price in Europe is usually higher than in all but a very few American cities. In Strasburg, for instance, it is practically 10 cents per kilowatt-hour, and the customer in addition pays a retail price for all his lamps, pays a government tax on the lamps, and pays a meter rent, so that his total cost, including lamps and meter rent, is probably 25 per cent to 50 per cent higher than in Chicago. The greater development was not due to the ease of wiring houses when they are built, because these European cities are composed almost entirely of stone and brick houses which were built before the days of electricity.

THE ANSWER IN EUROPEAN WIRING METHODS

But the difference we did find, and the difference that seems to account for the development in certain cities, was that they were using wire and wiring systems quite different from ours.

Before I take up the wiring I may give our answer to the question as to why it is only a few foreign cities, and not all, that have shown this great development, and this answer is that they get the development only when they apply American methods of business-getting and advertising on top of their better and cheaper wiring. The foreign cities which merely sit still and let the business come of itself are far behind us in development in spite of their wiring methods, but American business methods plus European wiring methods beat anything we have here.

Now, why is it that the foreign wiring methods are so different? The reason is that our code has since the early days had rules about grounding and not grounding that prevent the use of these foreign methods.

The foreign methods are, according to all available statistics, at least as safe as ours and apparently a good deal safer, for they have fewer fires than we do and fewer accidents to persons. Of course, their better record on fires and accidents is not due to their wiring methods alone, but their good record certainly indicates that their wiring methods are no more dangerous than ours and are probably safer.

There is no question, too, that our old code rule that forbade grounding was a danger rule, nor is there any question that when we changed this rule and allowed grounding we added to the safety of our wiring. The old rule, however, which forbade grounding also required that the neutral be insulated. This was covered by many clauses, all of which involved expense.

We changed one clause, first so as to allow and then to require the grounding of the neutral; but we provided for grounding it at only one point, or rather at only a few points, while all the other clauses which involved expensive insulation at other points were left in.

Now, the grounding of the neutral at one point removed the great danger that exists in low-tension ungrounded systems, but it did not decrease the expense except in a very minor degree. In fact, it added to the expense if anything.

THE GROUNDED NEUTRAL AS HARMLESS AS THE STEAM RADIATOR

In the old days we required that the neutral should be protected and insulated as though it might have the same potential as the other wires. We still require this same insulation and protection and expense, although the neutral or grounded wire can never be more than a very few volts above or below ground pressure. It is no more dangerous than a telephone wire or a bell wire; in fact, no more dangerous than a water pipe or a radiator. The water pipe is solidly connected to the neutral by the ground wire. Then what is the use of putting insulation for 600 volts between two substances that are at the same potential? Would it not be better engineering and safer in every way to put all this insulation between the wire that has a potential of 100 volts or more and the neutral, or between this potential wire and the water pipe or ground, than to have so much expensive insulation between bodies which are always at substantially the same potential?

It seems so obvious that I must ask your close attention to the reason why this change has not been made. The reason is that the only people interested to have it done have been the people whose houses were being wired, and these customers have never been organized.

When it was a question of danger, the central stations and every one else were interested to get the serious danger of ungrounded systems out of the old rules, because this change affected all the installations, old as well as new, and, if anything, made a little more work for wireman and manufacturer. The result was that the rules were changed so as to get rid of the danger of ungrounded systems, but the rules still require the expense of this insulation which is now unnecessary.

Consider our present conduit system with a neutral or grounded wire inside the conduit as well as the potential wire. The potential wire must have insulation to

keep it clear from the neutral wire or from the conduit. That insulation is necessary, but what good is done by the insulation between the neutral wire and the conduit?

Double Insulation for the Potential Wire

Suppose, instead, we put double insulation around the potential wire and none around the neutral? That means the system would carry double potential with the same safety, or be twice as safe at the same potential. Then suppose we make the conduit of copper, and then that we omit the neutral wire entirely. The result is still twice as safe as the present conduit system. When we have done this we have the equivalent of the bare concentric system, except that the copper conduit would require a great deal more labor to install and then pull the wire through than the concentric system by which the conduit and wire are put up as one operation.

Remember this: In the concentric system the potential wire is better protected than in the conduit system.

Please note that the bare concentric system is not at all the old one-wire system, such as that used for telegraphs or telephones and occasionally for ships. On the one-wire system the ground or frame of the ship was used as the return, and this caused trouble. The concentric system is not a one-wire system, but a thoroughly good return is provided.

Possibility of Foreign Currents

The danger of foreign currents entering the structure should be guarded against once for all for gas pipes, water pipes or any path where dangerous street-railway current might enter, but the neutral or grounded wire is no more dangerous than the water pipe or gas pipe, and so long as the neutral is grounded its *own* current is not a danger. The experience of this country is all in this direction, and the much greater experience abroad confirms it entirely. Do you suppose that millions of dollars' worth of concentric wire would be used abroad every year, and do you suppose that insurance companies would wire their own buildings with it, if it were not safe?

I am describing to you the line of thought that we went through when we decided that concentric wire and the things that go with it would be for the advantage of the American public and for the advantage of all the wiremen, nearly all the manufacturers, and all the underwriters. Of course, the advantage will be the same for all, and not for any particular wiremen or manufacturers or insurance companies as compared with their rivals.

All this study and investigation took time. The next step was to get the wire introduced. For this we had to get many persons working. The first step was Mr. Doane and Mr. Eisenmenger's paper [published in the Electrical World of May 23, 1914] read before the National Electric Light Association convention of 1914. That did not mean either wire or fittings, but in the fall of 1914 the General Electric Company consented to develop both, a very public-spirited thing to do, for there were no patents and all the company's development work would be for the advantage of its rivals as well as of itself.

Wire and Fittings Available

In the spring of 1915 some wire and models of fittings were ready and were submitted to the Underwriters, and a committee of the Underwriters reported very favorably at the March meeting. However, influences were at work which, while they could not prevent progress, yet aimed to delay it. Some people have got the impression that that March meeting rejected the system. If a system with the credentials of this one had been rejected on the arguments offered, it would have been a very serious matter for our whole system of making rules and codes; but the system, instead of being rejected, was merely referred back to the sub-committee for further investigation and report. This investigation is now going on, but has been delayed by the wait while getting out the fittings.

Even without the fittings, several installations have been made, using ordinary American fittings. The absence of specially designed fittings involved extra labor and expense, and in any case it takes a long time for workmen to acquire the same skill and speed that they have acquired by long experience with the old methods. Enough has been done, however, to satisfy us that as soon as the workmen have had anything like the experience with the new system that they have had with the old the costs will be much less, as well as the safety greater.

The Boston Experiment

In Boston we wired three houses. The first was very expensive, the second less so, and the third moderately reasonable. To illustrate the expense in the beginning, I may note that the third house had eighteen outlets, and that over twenty hours of workmen's time was devoted to interviews with inspectors and other visitors, besides the time spent in acquiring the necessary skill. All the time they were learning better and quicker methods of handling the wire, and when the fittings are ready the labor costs will be still less. We are also satisfied of one thing which should make the skilled workman in favor of concentric wire. Such wire cannot be handled by the janitor any more than he can handle logarithms without being taught, or than he could wipe joints like a plumber or cable splicer without being instructed. Good workmen, as soon as they have acquired the same skill that they now apply to our present wire, will work very quickly with the concentric wire, and the cost per outlet will be low with such workmen, even though pay per day be high. But the unskilled workman cannot handle it at all.

This point should be remembered, since one way to discredit the wire will be to put up poor installations or to give it to unskillful workmen and then to put forward their experience to delay the development.

I have tried to give you briefly the main points of the movement for wiring that shall be safer and better when all the money available can be devoted to making it safer and better, instead of wasting money in carrying out rules that were useful years ago but whose usefulness, now that we have the grounded neutral, has disappeared.

Permission for Optional Use of Concentric Wiring All That Is Now Asked

I may make one point in closing. We are not trying to forbid anyone from wiring by present methods. That time may come, just as grounding was made obligatory after it was made optional, but all we are asking for now is the option of putting in wiring and using methods that are theoretically sound and that have been proved practically successful in a great many installations.

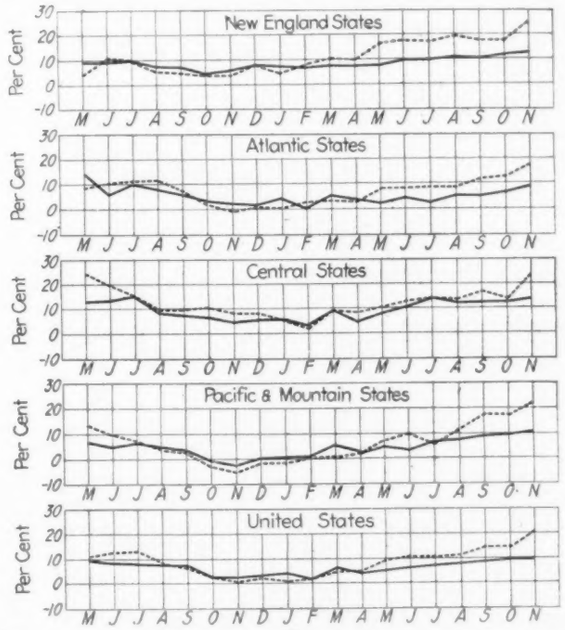
Of course, if our movement succeeds, the demand for certain devices may disappear; but I can't see where it will hurt anyone to have it *allowed* so long as it is not required. No one need use it unless he finds it better and safer than the present methods, which I am sure will be the case. We welcome, of course, suggestions and constructive criticism. We don't want every one to wait until some one else has worked out the very best possible plan, but let us all put our shoulders to the wheel and get the best and safest wiring that we can as soon as possible.

November Energy Output 1,765,000,000 Kw.-hr.

Increase for That Month of 300,000,000 Kw.-hr. Is the Largest Increase in Output in the History of the Lighting Industry—Earning Gain $3,500,000

DATA received by the ELECTRICAL WORLD on the income derived from the sale of electrical energy by central stations and the kilowatt-hour output for November, 1915, show an average increase over November, 1914, of 10 per cent in income and 21.3 per cent in output. The compilations were made from the returns received from 63 per cent of installed generator rating of both municipal and private operating plants in the United States. Only that output which is actually sold and money derived therefrom are included in these compilations. On the basis of these figures it is estimated that the November, 1915, earnings totaled $34,100,000, or $3,500,000 more than was earned in the previous November. The November output is estimated at 1,765,000,000 kw.-hr., which is the largest amount that the central-station industry has ever sold in any one month. The increase in output of 300,000,000 kw.-hr. is larger than that for any previous month by about 100,000,000 kw.-hr.

The New England States and the Central States seem to be keeping pace with each other in so far as the rate of growth is concerned, although the volume of business in the Central States is considerably more than in the New England States. The increase in November earnings in the New England States was 13 per cent and in the Central States was 13.9 per cent. In output the November increase in the New England States was 25.8 per cent and in the Central States was 23.8 per cent. That part of the industry operating in the Atlantic States has been rapidly gaining. Although the volume of business carried on in the Atlantic States is larger than in any other group, its rate of growth is not so large. The November increases in the Atlantic States were 8.9 per cent in earnings and 18.2 per cent in output. Companies in the Far West are again reporting large percentages of growth both for earnings and output. Earnings show a gain of 10.3 per cent in output, an increase of 22 per cent, for the month.



FIGS. 1 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT

These large percentages of growth are but another indication of the wave of prosperity which began to sweep over the United States last fall and which, as present reports indicate, is still gaining in momentum. In the South 12-cent cotton brought a boom to almost every industry there located. In the iron and steel mill region from Pennsylvania to Ohio there was more work in sight than could be handled. Those that for a long time before had been working on but part time and struggling along were forced daily to turn away orders, because deliveries could not be made for many months. In the Middle West the effects of the bumper harvest had begun to become apparent in swelling bank deposits, money easiness and buying. In the copper region from Montana to the Mexican border every mine that could get labor and equipment was busy. The advancing price of copper and the increased consumption foretold a boom time for the copper mines. In the Northwest the predominating influence of the lumber industry was again adding its note of optimism to the chorus. The New England States, of course, have long enjoyed a period of prosperity as a thickly settled, primarily industrial center easy of access and close to the Atlantic Ocean. The manufacture of war munitions, however, had by November lost to the manufacture of articles needed in peaceful occupations its place of first importance. In fact, so closely dependent is one section of the country upon the products of another that prosperity in one leaves its impression everywhere.

Owing to the suddenness with which this wave of prosperity swept over the country, the electrical industry reaped enormous benefits. Industrial plants operating on isolated-plant energy found themselves without motive power in most instances sufficient to cope with the large volume of orders. It was impossible at the time to enlarge their stations and therefore they resorted to electricity. Many industries with a small individual power equipment or inadequate equipment found it economical and more efficient to make an entire installation, taking energy from the central stations' mains. This is particularly noticeable in the steel industries and in mining industries. Those factories which were shut down during the past lean years and have been again put into commission found in many cases the motive-power equipment to be in almost un-

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
1914 Dec..	65	$20,978,430	$20,281,812	3.3	1,074,083,543	1,043,457,795	3.0
1915		1915	1914		1915	1914	
Jan..	65	21,582,547	20,697,423	4.1	980,085,036	966,200,323	1.4
Feb..	63	19,395,518	19,023,107	2.0	853,817,221	835,288,039	2.2
Mar..	64	18,654,443	17,529,054	6.4	939,117,179	896,903,968	4.8
April	65	18,406,412	17,675,784	4.2	900,536,022	859,235,144	4.8
May..	65	17,644,205	16,764,546	5.3	920,895,324	842,386,583	9.3
June..	65	17,603,614	16,476,255	6.9	925,067,308	836,292,076	10.6
July..	64	18,488,793	17,200,827	7.5	971,699,054	880,768,487	10.4
Aug..	64	17,342,796	16,024,893	8.2	951,752,053	853,381,696	11.3
Sept..	64	18,458,131	16,999,624	8.6	995,621,322	864,540,235	15.2
Oct..	64	20,016,861	18,243,491	9.7	1,079,729,114	941,966,241	14.8
Nov..	63	21,463,672	19,348,613	10.0	1,111,852,632	916,586,764	21.3

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States 1914	New England States 1913	Per Cent Increase	Percentage of Industry Represented	Atlantic States 1914	Atlantic States 1913	Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded) 1914	Central States (Illinois Excluded) 1913	Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States 1914	Pacific and Mountain States 1913	Per Cent Increase
INCOME	Dec.	67	$2,385,711	$2,218,387	7.5	69	$8,765,275	$8,594,773	2.2	57	$5,992,542	$5,654,740	5.9	88	$3,834,902	$3,813,912	0.3
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	2,423,795	2,271,881	6.8	69	9,075,335	8,695,593	4.4	57	5,827,997	5,525,579	5.4	88	3,960,608	3,917,371	1.0
	Feb.	67	2,246,794	2,134,341	5.4	69	8,037,878	7,968,625	0.9	55	5,296,786	5,148,439	3.0	85	3,576,432	3,534,864	1.2
	March	67	2,146,032	1,999,326	7.5	69	7,777,126	7,419,808	5.2	55	4,885,384	4,465,728	9.5	88	3,605,893	3,412,842	5.8
	April	67	2,109,767	1,976,473	6.8	69	7,510,810	7,241,164	3.9	57	5,003,673	4,773,949	4.8	88	3,475,740	3,366,830	3.2
	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	57	4,946,907	4,577,818	8.1	88	3,383,749	3,233,989	4.8
	June	67	2,063,423	1,874,575	10.2	69	6,945,986	6,628,523	4.8	57	4,993,410	4,492,411	11.2	88	3,409,738	3,281,696	3.9
	July	66	2,020,513	1,835,968	10.2	68	6,710,217	6,519,442	2.9	56	4,801,699	4,211,641	13.9	88	3,539,168	3,317,713	6.8
	August	63	2,057,635	1,855,140	11.0	68	6,853,118	6,511,307	5.3	56	4,749,082	4,231,322	12.2	88	3,545,454	3,288,729	7.8
	September	65	2,162,064	1,949,663	11.0	68	7,288,842	6,904,245	5.5	56	5,205,532	4,625,419	12.6	87	3,655,002	3,378,746	8.2
	October	65	2,327,214	2,073,059	12.3	68	8,091,584	7,545,467	7.3	56	5,739,900	5,082,469	13.0	87	3,788,211	3,467,238	9.2
	November	64	2,472,539	2,188,049	13.0	66	8,786,048	8,071,549	8.9	54	6,149,583	5,403,963	13.9	87	3,936,366	3,568,808	10.3
KW.-HR. OUTPUT	Dec.	67	78,510,793	71,990,132	7.8	69	401,623,514	396,251,867	1.2	57	315,027,232	291,511,670	8.0	88	278,922,004	283,704,076	1.6*
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	72,550,608	69,317,803	4.7	69	374,972,536	373,336,906	0.7	57	272,623,760	258,572,903	5.5	88	252,531,483	256,198,272	1.4*
	Feb.	67	66,600,132	61,515,979	8.3	69	312,443,505	305,307,260	2.4	55	238,938,034	232,520,476	2.7	85	229,865,568	229,185,967	0.3
	March	67	72,121,319	65,343,335	10.5	69	346,341,496	335,506,429	3.3	55	257,136,231	235,656,647	9.2	88	255,529,704	253,423,951	1.0
	April	67	68,475,232	62,442,110	9.7	69	320,142,323	311,476,008	3.0	57	257,967,434	237,673,326	8.5	88	246,287,781	239,661,364	2.8
	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	57	262,885,043	236,154,464	11.2	88	254,586,394	236,082,868	7.8
	June	67	71,566,127	60,972 379	17.4	69	318,245,370	293,751,083	8.5	57	265,930,311	234,286,440	13.2	88	261,083,835	237,843,021	9.8
	July	66	71,025,184	60,755,381	17.0	68	320,371,761	293,909,832	9.0	56	264,498,989	232,541,585	13.9	88	274,488,334	258,475,004	6.3
	August	63	71,954,506	60,870,433	18.5	68	329,947,721	302,960,234	8.9	56	272,508,518	240,423,753	13.4	88	276,631,551	248,463,980	11.3
	September	65	74,835,203	63,716,246	17.3	68	358,765,971	319,549,780	12.3	56	279,108,350	240,176,157	16.3	87	278,933,924	237,633,240	17.5
	October	65	82,568,951	69,882,867	18.3	68	400,409,650	353,594,256	13.1	56	298.226,414	261,933,219	14.0	87	292,670,773	250,903,551	16.7
	November	64	87,193,883	69,359,620	25.8	66	415,244,000	351,500,177	18.2	54	313,274,244	252,919,776	23.8	87	288,550,881	236,397,558	22.0

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
INCOME:									
Group 1	8.0	3.8	4.8	6.5	5.3	7.2	7.3	8.7	9.8
Group 2	6.9	5.0	6.2	2.8	8.8	9.1	10.0	11.4	12.1
Group 3	5.2	5.5	5.8	10.1	9.7	14.5	15.4	23.4	18.0
Group 4	5.0	3.9	7.1	6.9	8.2	8.0	9.0	8.9	12.5
Group 5	1.6*	1.9	5.5	4.7	8.5	7.5	11.9	7.1	12.1
OUTPUT:									
Group 1	5.7	5.4	7.2	10.1	11.1	9.7	12.2	10.7	17.0
Group 2	7.9	11.2	13.1	9.1	18.1	19.0	18.9	21.4	28.2
Group 3	3.6*	1.2*	6.1	11.2	4.5	13.0	24.0	27.3	36.0
Group 4	3.2	3.0	29.1	6.0	12.5	10.9	11.3	13.5	18.5
Group 5	7.0	5.9	15.5	14.8	20.5	12.7	19.3	4.4	15.2

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
INCOME:									
Group 1	6.6	6.3	9.4	11.6	11.2	11.0	10.6	12.7	13.8
Group 2	9.0	4.04	7.5	7.0	7.0	9.6	10.3	12.6	12.7
Group 3	7.8	20.6	8.9	21.8	10.2	16.5	14.7	17.3	15.5
Group 4	6.5	8.4	7.1	11.9	6.6	9.2	10.0	8.8	9.0
Group 5	14.7*	0.4*	1.0*	2.8	16.0	21.2	5.8	8.3	13.7
OUTPUT:									
Group 1	12.0	12.7	16.0	19.0	17.2	17.2	19.2	20.8	28.7
Group 2	12.3	12.3	19.9	20.8	26.0	26.0	21.7	18.3	30.0
Group 3	0.3*	3.2	7.0	17.9	13.5	12.3	14.4	8.7	23.0
Group 4	12.5	12.1	6.3	17.1	7.8	13.6	9.0	20.6	20.1
Group 5	29.8*	25.5*	13.5*	1.0	11.0	15.1	8.5	1.8	51.0

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
INCOME:									
Group 1	4.7	1.6	2.0	3.8	1.4	4.0	4.4	6.2	7.6
Group 2	7.1	5.6	8.2	8.0	9.7	11.6	11.0	11.9	13.2
Group 3	3.8	4.1	1.6	7.5	7.5	8.5	8.9	11.0	10.0
Group 4	6.8	2.9	6.2	3.9	7.0	8.4	10.0	10.0	13.9
Group 5	†	15.2	19.6	14.8	†	2.0*	14.3	10.9	14.6
OUTPUT:									
Group 1	6.1	4.8	9.0	8.2	8.0	9.0	11.6	12.1	16.0
Group 2	9.7	7.6	7.1	11.0	17.0	15.0	16.3	16.8	23.0
Group 3	8.5*	4.1*	3.2	7.2	7.5	6.4	10.4	15.8	22.1
Group 4	10.2	1.9	22.5	7.1	13.8	13.2	12.5	14.8	22.6
Group 5	†	57.2	71.5	61.8	†	11.4	13.8	2.8*	18.6

*Decrease. †Results omitted owing to insufficient returns.

usable condition owing to the long period of disuse; but by using central-station power no delay was caused. Night and day shifts and more intensive work have increased the lighting load beyond all former record.

The curves shown herewith present graphically the percentage increases in Tables I and II. The remaining tables give the percentage increases for companies grouped according to size. Group 1 is based on the joint companies operating in cities having a population of over 100,000 inhabitants. Group 2 includes cities having between 50,000 and 100,000 inhabitants; group 3, between 35,000 and 50,000; group 4, between 10,000 and 35,000, and group 5, between 5000 and 10,000.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
INCOME:									
Group 1	10.1	7.3	9.8	11.4	11.8	12.2	12.4	12.3	13.1
Group 2	5.9	3.5	3.0	5.6	7.0	7.5	8.6	9.8	10.0
Group 3	11.3	10.4	15.5	19.6	16.4	21.0	22.0	22.7	24.0
Group 4	8.3	6.0	6.7	12.4	13.0	16.9	17.9	16.3	20.3
Group 5	7.7	7.6	19.9	5.0	1.2	20.2	13.5	10.6	12.1
OUTPUT:									
Group 1	7.7	6.8	8.4	10.8	11.8	12.2	15.2	10.4	22.3
Group 2	8.0	12.5	9.7	13.5	11.1	9.8	9.0	18.0	20.1
Group 3	14.7	13.1	27.0	26.1	28.9	31.0	29.3	34.2	43.0
Group 4	12.8	7.9	10.0	15.7	18.2	26.1	29.0	23.5	38.5
Group 5	13.5	39.7	28.8	20.4	24.9	25.1	48.0	27.0	33.8

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
INCOME:									
Group 1	8.1	4.0	3.1	9.0	5.1	7.0	13.9	7.5	8.0
Group 2	7.5	9.4	12.7	11.1	13.0	11.1	11.5	14.3	15.7
Group 3	1.0*	0.3*	3.4	3.6	7.9	17.1	19.7	21.4	20.0
Group 4	2.6*	3.8*	8.7	1.6*	7.8	0.2	0.3	0.2	5.4
Group 5	3.5*	2.7*	2.4*	3.3	4.5	1.7*	15.0	3.1	10.9
OUTPUT:									
Group 1	2.5	4.5	2.3	10.8	6.2	6.3	8.4	7.1	10.7
Group 2	3.0	11.6	19.0	14.9	27.5	39.3	40.3	41.3	51.0
Group 3	4.0*	3.5*	3.8	12.4	8.4*	18.5	49.2	52.4	67.0
Group 4	9.5*	4.7*	87.0	4.5*	11.8	0.2	4.1	1.4	2.7
Group 5	18.0	9.6	18.5	3.6	10.9	8.0	21.0	3.5	7.5

*Decrease.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Motor-Driven Pumping Installation at Leonard Mine, Butte, Mont.

Automatic Contactor Control of 150-Hp. Motors Geared to Pumps Working Against 1200-Ft. Head, and Arrangement of the Drives.

BY R. H. RICHARDS

FIVE pumps, each able to deliver 300 gal. per minute against a head of 1200 ft. and each directly connected through herringbone gears to two 150-hp. induction motors, are installed on a 1200-ft. level of the Leonard Mine at Butte, Mont., operated by the Anaconda Copper Mining Company. The pumps are of the quintriplex type, with the two 150-hp. three-phase, 440-volt, 490-r.p.m. induction motors mounted above them as shown in Fig. 2. The amount of water delivered by this equipment varies from a minimum of 1100 gal. to a maximum of 1400 gal. per minute. The pumps are operated in connection with a storage reservoir, which is large enough to take care of five hours' storage.

The structure housing the pumping equipment is 120 ft. long by 19 ft. wide and 19 ft. high, built of 24-in. by 24-in. timbers, made up of four 12-in. by 12-in. timbers bolted together. The roof of the structure is made in the form of a half-hexagonal arch and lagged with 2-in. by 10-in. rough boards. All timbers were fitted complete on the surface and lowered in a 3-ft. 4-in. by 4-ft. 1-in. shaft to the 1200-ft. level. In Fig. 2 the switching room housing the equipments in Fig. 3 is shown at the end of the station. This switching room is of reinforced concrete 34 ft. by 11 ft. by 9 ft. high. The control equipment consists of one main 2000-amp. automatic three-pole oil switch with overload and no-voltage release. Four Westinghouse automatic contactor control switches each equipped with a set of air-brake disconnecting switches and an ammeter and one General Electric automatic control switch similarly equipped are installed. Stop push-buttons are mounted on the wall in front of each pump, and starting push-buttons on each control panel. There is a 50-kw., three-phase, 440-volt to 110-volt transformer for emergency lighting also installed in this switch room.

FIG. 2—PUMP ROOM, SHOWING GEARS CONNECTED TO MOTORS ABOVE, ALSO SWITCH ROOM IN THE REAR

All wiring in the pumping station is installed in concrete, and all wire used in the switching room has a slow-burning asbestos insulation. Energy is brought to this pumping station through five three-conductor 4/0 lead-covered cables formerly used to furnish energy

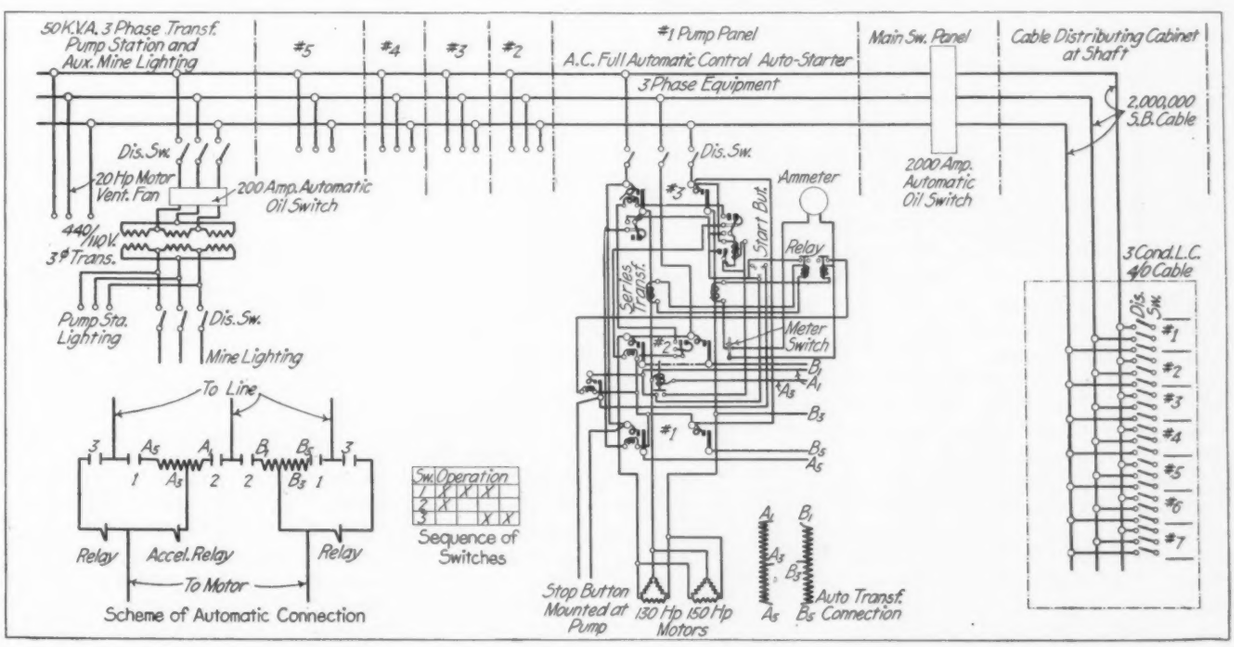


FIG. 1—DIAGRAM SHOWING FEEDER AND AUTOMATIC CONTROL ARRANGEMENTS FOR PUMP MOTORS IN LEONARD MINE

to other equipment. A steel cabinet is installed at the shaft, and the cables are connected by air-break switches to the three 2,000,000-circ. mil cables leading to the main switch. The control circuits for the contactor switches and feeder arrangements are shown in the accompanying diagram.

The pumps for this installation were designed and

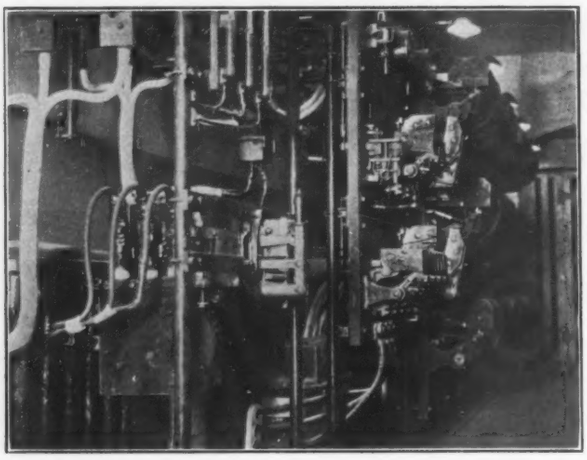


FIG. 3—AUTOMATIC CONTROL PANEL IN SWITCH ROOM OF LEONARD MINE

built by the A. C. M. foundry at Anaconda, Mont., and all valves, plungers and pipes in the station are of cast bronze. The column pipes are of cast steel, wood-covered, and two in number. Each pump is arranged to operate on either column pipe. Four of the pumps are operated by Westinghouse induction motors, and one pump by General Electric induction motors.

How Generating Facilities Are Provided Economically for Small Lighting System

The Provincetown (Mass.) Light & Power Company operates a small central-station lighting system on Cape Cod. Recently a 125-kw. Curtis turbo-generator has been installed in the plant of the Cape Cod Cold Storage Company, near the center of the town on the water front under conditions to secure economical and reliable service. The electric company owns this machine, with its foundations, piping and switchboard, but the unit is operated by the engineers of the Cold Storage company, the lighting company paying for this service on a contract basis which takes into account fuel, lubrication, labor and rent. By this arrangement the unit is operated at night without the maintenance of an exclusive staff for central-station service, and the lighting company is not required to carry an investment in boilers, handling equipment, stack or other portions of the "steam end" of the station.

The turbine is connected with a C. H. Wheeler condenser and operates at 3000 r.p.m. The turbo-generator cost $4,400, the switchboard (a 2300-volt outfit) $1,063, the turbine foundation $759, piping and fittings $1,661, and labor of installation $3,135.

Prior to the installation of the turbo-generator the company operated an oil-engine plant situated about a mile outside the village. This plant is now held in reserve and contains two belted generators of 165 kw. total rating and a 120-hp., three-cylinder Diesel engine, one generator being held in reserve. The engine was purchased in 1907 and has since been rebuilt. The value of this plant in 1913, as appraised by Walter R. Eaton of the Cambridge (Mass.) Electric Light Company, was $12,593. The old plant is surrounded by sand dunes and is out of reach of any fire likely to occur in the town, even in view of the high winds which sweep the tip of Cape Cod at many seasons. It is connected with the distribution system by an independent line and can be started in a few moments by the company's superintendent, without the aid of a licensed engineer or fireman, in case of trouble at the steam plant of the Cold Storage company. This reserve is carried at less cost than would be the case if the company had disposed of the oil-engine station and added extra steam equipment.

In the past two years the company has expended $19,037 in line extensions as follows:

Wire (35,806 ft. of No. 1 to No. 8)	$3,045
Eighty-nine poles—40-ft.	441
356 cross-arms—two-pin to eight-pin	225
Labor and miscellaneous items	15,326
Total	$19,037

Provincetown is a small seaside place characterized by frame buildings and unusually narrow streets. On account of the fire risk, the central-station company has insured its poles, wires and transformers along the main street. This system is operated by C. D. Parker & Company of Boston, Mass., and Provincetown is the only town in which the company has found such insurance necessary. No day load is carried at present.

How a Bonus System and Steam-Flow Meter Are Used to Maintain Economical Loads on Boilers in Wisconsin Station

The accompanying table has been prepared by the Mineral Point (Wis.) Public Service Company to show firemen the actual loss in coal and money when boilers are not operated at their most economical rating. At the Mineral Point station of the company firemen are paid a bonus to operate boilers at best rating, as indicated by a steam-flow meter. This bonus ranges up to $10 a month, averaging about $6, and is based on the quality of work, taking into consideration evaporation,

LOSS OF COAL AND MONEY FOR POSITIONS OF THE POINTER ON A STEAM-FLOW METER ABOVE AND BELOW A CERTAIN READING

Position of Steam-Flow Pointer	Load on Boiler-Horsepower	Loss in Coal, Lb.		Loss in Money	
		Per Day	Per Hour	Per Day	Per Hour
2.5	293	21,600	900	$28.00	$1.16
3.0	354	16,400	685	21.30	0.89
3.5	413	10,000	417	13.00	0.54
4.0	472	2,800	116	3.75	0.16
4.5	531	0	0	0	0
4.75*	562	0	0	0	0
5.0	587	400	16	52	0.02
5.5	648	3,200	133	4.17	0.17
6.0	707	7,200	299	9.36	0.39
6.5	766	10,000	417	13.00	0.54
7.0	825	17,600	745	22.90	0.95
7.5	885	22,400	935	29.10	1.21
8.0	945	27,600	1145	35.90	1.49

*Blue circle.

steam pressure, water level, CO_2 readings, flue-gas temperature, position of fires in relation to bridge wall on chain grate, prevention of pops, blowing down, blowing flues, and general operation. The bonus is awarded on a percentage-marking system under control of the boiler-room foreman, who receives a salary and does not participate in the bonus system. Thus far the method has worked out satisfactorily in the Mineral Point plant, according to H. G. D. Nutting, who is consulting engineer for the company.

Handy Method of Filing Continuous-Curve Records

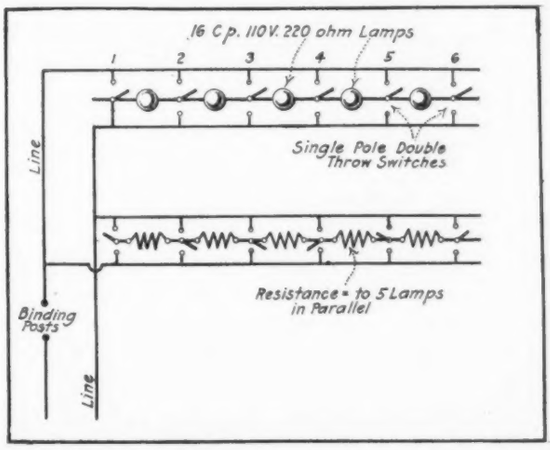
The ordinary method of preserving continuous-curve sheets made by recording instruments is to roll up long sections and store the roll in a desk drawer. A better method of handling such plant data is used by the engineers of the Ohio Light & Power Company at Newark. This consists simply of cutting the sheets into twenty-four-hour sections and placing them in chronological order on a series of steel wall pegs arranged so as to fit the side holes in the sheets. Curves filed in this way form an information bureau which may be referred to without the inconvenience and loss of time incident to unrolling yards of paper ribbon.

Convenient Adjustable-Resistance Scheme for Testing Work

BY JOHN B. LEAKE

On page 85 of the Jan. 8 issue of the ELECTRICAL WORLD R. H. Langley described a switching arrangement for a lamp bank. In the accompanying diagram the writer suggests another scheme which makes possible a considerable saving by replacing lamps by resistance coils. A finer range of adjustment is also possible and the wiring somewhat simplified. The arrangement shown gives currents up to 15 amp., with changes of 0.1 amp. in some of the combinations when built with five lamps and five pieces of resistance wire capable of carrying the equivalent of five lamps in parallel, controlled by twelve single-pole, double-throw switches. With 220-ohm lamps on a 110-volt circuit the following results can be obtained:

By placing the lamps across the line one at a time the current is increased 0.5 amp. up to 2.5 amp. Then by raising all lamp switches and connecting one resistance coil across the line 2.5 amp. flows, with the lamps free for securing a further 0.5-amp. adjustment. This process can be continued to the full capacity of the board.

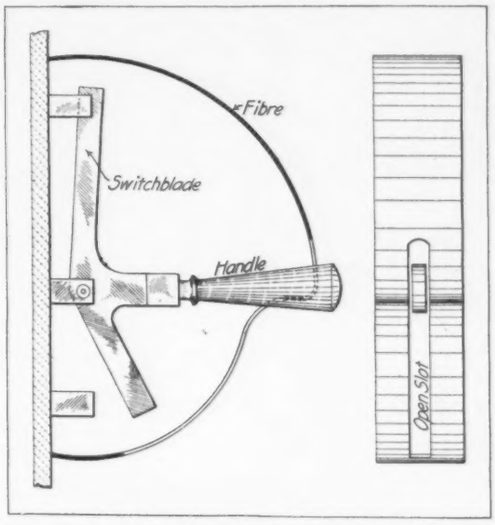


AN ARRANGEMENT OF LAMPS AND RESISTANCE COILS THAT GIVES CURRENT VALUES UP TO 25 AMP.

Other combinations can be made as follows: By leaving switch 1 open and closing switch 6 up the five lamps are in series across the line, and the current can be increased by placing 5, 4, 3, etc., in the position of 6, thus cutting down the series resistance. The same process can be worked on the resistance-coil switches, to place the five coils in series, making the equivalent of one lamp, thus freeing the lamp switches for further fine adjustment. It should be noted, however, that decreasing the units in series does not produce an equal effect on the current each time, as the ratio of the unit to the number in series increases as the coils are cut out. The small cost of this equipment makes its construction practical even in places not having constant demand for such a resistance. The writer has used a slightly different form of this arrangement with entire satisfaction.

A Guard for Field Switches Used in Detroit Station

In the Conners Creek station of the Detroit Edison Company the live parts of generator field switches are inclosed. The covering used is of fiber arranged as shown in the accompanying diagram to fit against the switchboard and to inclose all parts of the switch ex-



FIBER GUARD THAT INCLOSES LIVE PARTS OF FIELD SWITCH

cept the end of the operating handle. It protects operators, therefore, from coming in contact with live parts and from the possibility of receiving burns in case an arc is drawn.

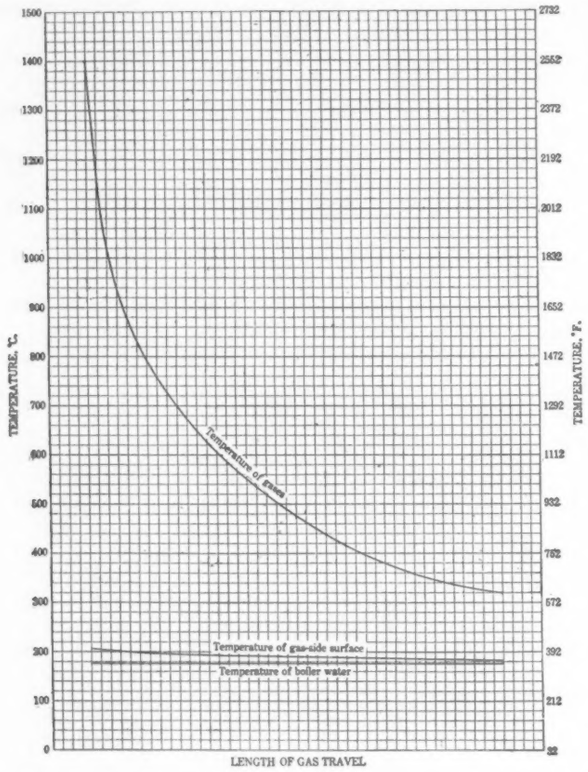
Heat Transmission Through the Metal of Boiler Tubes

The results of a study of the transmission of heat through the metal of the heating plates of boilers are presented in Technical Paper 114 of the Bureau of Mines, as compiled by Henry Kreisinger and J. F. Barkley. A large number of temperature determinations were made of both surfaces of boiler tubes in a Heine water-tube boiler while the unit was in operation.

The results of these temperature measurements show that the temperature of a boiler tube is within 10 deg. C. to 20 deg. C. of the temperature of the boiler water, and that the temperature of the tube is affected very little by the temperature of the hot gases but follows the temperature of the boiler water. As the temperature drop along the path of heat travel is nearly proportional to the resistance to heat travel, the resistance appears to be very high from the hot gases to the gas-side surface of the tube and very low from this surface to the boiler water. This fact indicates that a boiler tube can transmit very easily all the heat that can be imparted to it by the hot gases, and that as long as the tubes are kept free from scale, oil and other deposits and filled with water it is impossible to overheat the tubes, no matter how hard the boiler may be worked.

The slow part in the path of travel is from the hot gases to the boiler tubes. It is this part of the path that is responsible for the slow rate of heat transmission in boilers as now designed and operated. Anything that will increase the rate of heat impartation from the hot gases to the boiler tubes will almost directly increase the rate of working of the boiler. This is an important fact and should be kept in mind by the designer when designing a boiler which is to be operated at high rating.

In Fig. 1 the approximate temperature drop of the gases and of the gas-side surface of the heating plate along the path of the gases, as they pass over the heating plates of the boiler, is given. It is pointed out that it is not a question of how much heat a boiler's heating plate can transmit but how much heat can be imparted to it by the hot gases. The heat conductivity of iron is



CURVES SHOWING PROBABLE TEMPERATURE DROP ALONG THE PATH OF THE GASES OVER BOILER TUBES

so high that only a small difference in temperature is needed on the two sides of the heating plate to transmit heat at the rate of 1 boiler-hp. per square foot of heating plate. The ability of the boiler water to take heat away from the heating plate is so great that only a small temperature drop is necessary to transmit the heat from the plate to the water. These facts seem to prove that in steam boilers it is the gas-side surface of the heating plate that counts. The water-side surface has very little effect on the rate of heat transmission. The equation given in some textbooks which states that the rate of heat transmission is proportional to the square of the temperature difference between the hot gases and the boiler water is, the authors point out, only roughly approximate and is practically worthless for steam-boiler problems.

The rate of heat conduction of iron at a temperature of 100 deg. C. to 200 deg. C. is given as 2300 B.t.u. per hour per square foot of area when the iron plate is ⅛ in. thick, and the difference of temperature between the two surfaces is 1 deg. Fahr. It is considered that 1 boiler-hp. per 0.357 sq. ft. of heating plate is not high.

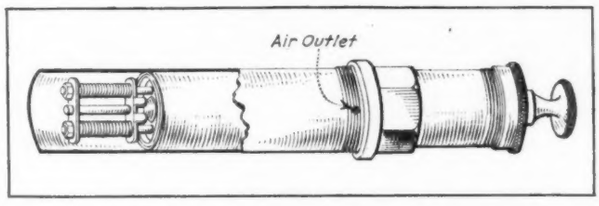
Utilizing Return from Hot-Water-Heating System for Condensing Turbine Exhaust

By circulating the return water from its hot-water-heating system through a Westinghouse-LeBlanc jet condenser, into which exhausts a 900-kw. turbo-generator, the Merchants' Light & Heating Company, Indianapolis, Ind., has been able to secure a 24-in. vacuum with a load of 850 kw. on the turbine. This performance was obtained with the unusually high-water inlet temperature of 138 deg. Fahr. and an outlet temperature of 144 deg. Fahr., which seems to indicate that condensing prime movers may be operated in connection with hot-water-heating systems at relatively high vacuum while maintaining a proper temperature of the circulating water in the heating system. It may be pointed out that the exhaust steam temperature corresponding to the 24-in. vacuum was within 1 deg. of the average circulating-water temperature. When systems are laid out with this method of condensing in view the turbines should be specified with a maximum efficiency at the vacuum corresponding to the circulating-water temperature required during the greatest number of hours that the turbine is to be operated.

How to Avoid Trouble with an Electrician's Gasoline Torch

BY H. H. KENNEDY

In the Jan. 15, 1916, issue of the ELECTRICAL WORLD, page 154, A. Hearvey refers to troubles with an electrician's gasoline torch. This article recalled to the writer a simple and ingenious device which made it possible to overcome troubles with torches experienced some time ago. In the ordinary gasoline torch it seems that gasoline works its way up through the check valve of the pump, cuts out the packing, and eventually fills the pump cylinder. This is caused by faulty seating at



A JACKET THAT EXCLUDES GASOLINE FROM TORCH PUMP AND PREVENTS OIL FROM MIXING WITH GASOLINE

times of the check valves after the torch is in service. Also, when the pump cylinder is flooded with lubricating oil occasionally, the oil promptly works out into the gasoline, through the check valve, later clogging the burners and causing much trouble. In short, all of our torch troubles were traceable to the pump as the initial source. Several makes of torches were tried, but the above-mentioned troubles would soon develop.

In the usual construction of torches the pump check valves are immersed in the gasoline. To overcome this handicap on the pump, a clever manufacturer puts the pump in a tube or jacket, as shown in the accompanying drawing. This jacket is closed at the lower end, leaving a small clearance between pump and jacket, but entirely inclosing the pump and its valve, except for a small hole punched in the side of the jacket near the top edge and above the gasoline level. Since the jacket is sealed around the top of the pump and the hole is very small, gasoline will not flow into the jacket air-pocket space, even with the torch inverted, as there is no outlet for the displaced air. This arrangement was devised by the Sherwood Manufacturing Company, Liberty, Ind.

MARKETING ELECTRICITY

A Department on Selling Service and Widening the Use of Electrical Energy

Enlisting the People's Aid in a House-Wiring Campaign

A Story of Unusual New-Business Measures That Proved Very Successful in the Territory of the Edison Electric Illuminating Company of Lebanon, Pa.

BY A. LANDRETH SCOTT
Sales Manager.

IN spite of the number of stories of house-wiring campaigns that we all have read within the last few years, I believe that the details of our recent experience in Lebanon, Pa., will interest central-station commercial men. It was a short campaign and an intensive one, but it was successful and productive, though it was worked in a field long cultivated, because, fortunately, we were able to build up a spirit of "opportunity" that won the public interest—and the contracts.

Lebanon is a city of approximately 22,000 inhabitants, and the Edison Electric Illuminating Company has been at work among them, year by year, exerting constant influence to increase the sale of electricity for every kind of service. We have been successful in good measure, but the number of unwired houses still looms large, just as it does in almost every other city, and it was decided last October to put on a house-wiring campaign that if possible would spread the modern conception of electric service with enthusiasm and sweep in as many as possible of those homes that are denying themselves this most essential comfort, principally through failure to appreciate the ease with which it is obtained to-day. The idea was to make a rapid-fire campaign for fifteen days, and we planned enough novel features to insure the winning of the popular attention and interest.

THE PLAN OF THE CAMPAIGN

As the first step we compiled a mailing list of 513 names, combed from our telephone directory, from electric-show records, and from our sales-department lists. We adopted and advertised a slogan, "Yesterday's Luxury, To-day's Necessity—Electricity," and prepared five letters on special tinted stationery, with a different color for each mailing, and on each an artistic picture that attracted the attention and harmonized with the subject of the letter. Our idea in compiling the list and not making a straight canvass was to create a simultaneous interest all over the city, as our list covered every nook and corner. Had we canvassed, some time at least must have elapsed before our men could have reached all sections of the city, and interest in one end might have waned before the last section was reached. So the letters were sent out to open the campaign, one letter each week.

To insure the hearty co-operation of the local contractors and make it possible for our men to take wiring orders at the time of selling, with assurance that immediate installation could be made, we made arrangements with three of our leading contractors to handle our work at flat prices as given in the table on this page. These prices included lamps, Underwriters' inspection, and, in fact, everything complete, ready to light.

SCHEDULE OF CONTRACTORS' WIRING PRICES

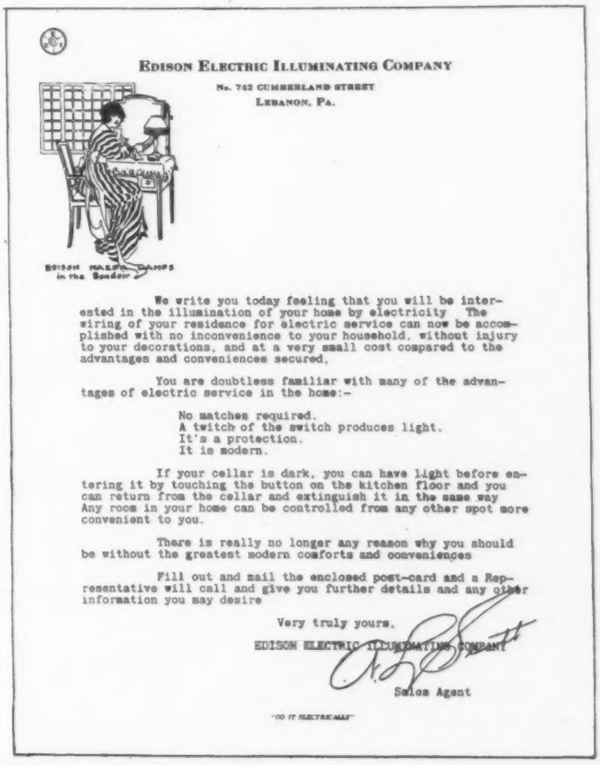
First six outlets, including cellar conduit	$19.20
All other outlets and switches	2.60
One lamp fixture complete with pull-chain socket and lamp	1.52
Two-lamp fixture complete with pull-chain sockets and lamps	3.24
Three-lamp fixture complete with pull-chain sockets and lamps	4.51
One lamp bracket complete with lamp	1.17
One lamp ball and bank complete with pull-chain socket	1.17
Special flatiron receptacle with ruby light wired for special circuit	5.00
(When house is already piped for gas, an additional charge of 32 cents is made for each fixture hung on gas pipe.)	
Set of three-way flush switches	5.00
Set of three-way switches and one four-way switch	7.00

Discount, 5 per cent for cash. Additional 10 per cent discount for contracts closed within fifteen days from start of campaign.

HUGE GLASS BALLS AS AUXILIARIES TO NEWSPAPER "ADS"

The Lebanon co-operative campaign was energetically advertised in the city's newspapers and commanded immediate attention, especially when, just five days after the opening of the campaign, a reduction in rates was announced that made the cost of lighting homes and stores figure 11 cents per kilowatt-hour for the first sixty hours' use each month and 6 cents for all consumption in excess of that. Naturally this reduction appealed to every one; the newspapers commented extensively on it, and many people who had been wavering before decided to "wire up" at once.

The newspaper advertising was, moreover, supple-



EDISON ELECTRIC ILLUMINATING COMPANY
No. 742 CUMBERLAND STREET
LEBANON, PA.

We write you today feeling that you will be interested in the illumination of your home by electricity The wiring of your residence for electric service can now be accomplished with no inconvenience to your household, without injury to your decorations, and at a very small cost compared to the advantages and conveniences secured,

You are doubtless familiar with many of the advantages of electric service in the home:—

No matches required.
A twitch of the switch produces light.
It's a protection.
It is modern.

If your cellar is dark, you can have light before entering it by touching the button on the kitchen floor and you can return from the cellar and extinguish it in the same way Any room in your home can be controlled from any other spot more convenient to you.

There is really no longer any reason why you should be without the greatest modern comforts and conveniences

Fill out and mail the enclosed post-card and a Representative will call and give you further details and any other information you may desire

Very truly yours,
EDISON ELECTRIC ILLUMINATING COMPANY
Sales Agent

ONE OF THE LETTERS WHICH OPENED THE CAMPAIGN

mented with another most effective method of keeping the campaign in the public eye by installing along the streets throughout the city 14-in. glass balls with catchy phrases painted on them, such as "Do it electrically," "Have your home wired now," "It is cheap, clean and convenient," "If it isn't electric, it isn't modern," "Electricity is protection," "Safety first—use electricity," and others of a like character.

These glass balls, with a 300-watt type C Mazda lamp in each, were placed on our poles and on numerous store fronts, turned on at dusk and left to burn until the "wee, sma' hours" of the morning. They attracted a great deal of attention, brought much comment from the public in general, and received complimentary recognition from the newspapers.

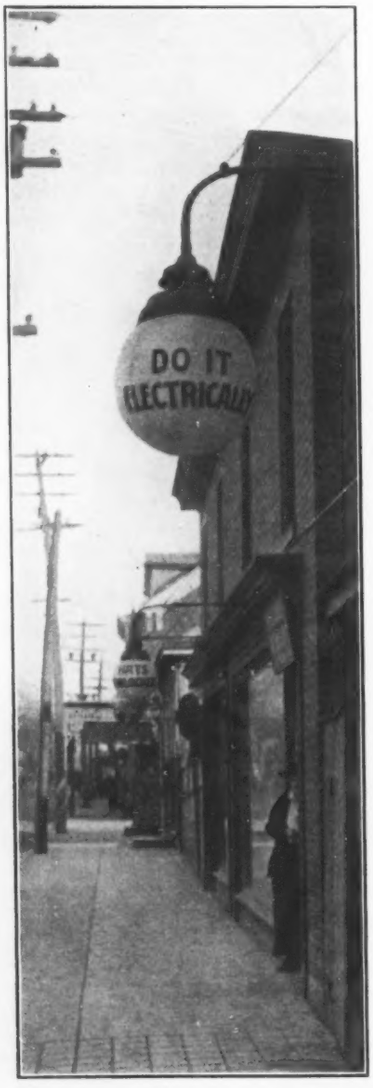
But the great objective in this campaign was to create a widespread interest in the homes themselves and get the people talking about electric light and "boosting" for the company, and so we introduced two innovations that brought direct results immediately and put into the field a hundred independent advocates of electric service who combed the city for us.

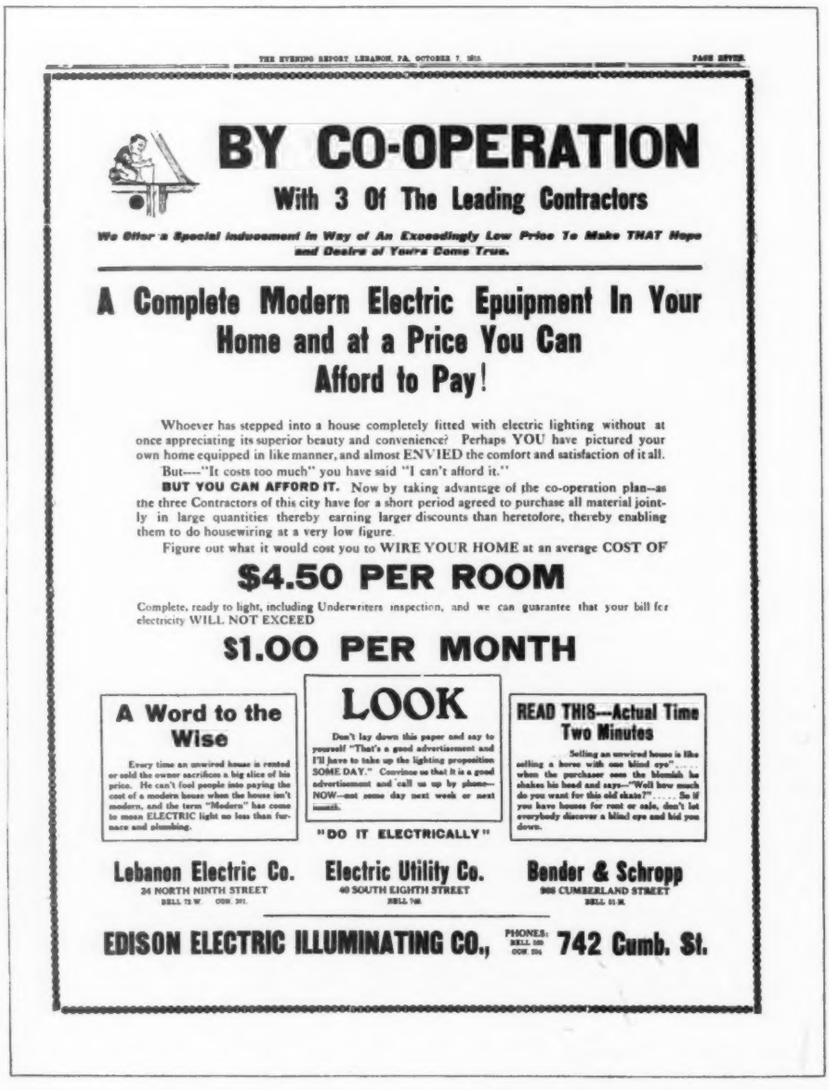
Enlisting the Little Folks

Everyone knows the value of children both as advertisers and as solicitors, for they are good little chatterboxes and good little coaxers. To enlist their aid in our campaign to get the public thinking electrically and doing electrically, we offered to all the school children a commission of $1 for the submission of the name of any person who should subsequently sign a contract for the wiring of his house. The only thing necessary for the children to do was to call on their many friends —and what school "kid" doesn't have hosts of them?— and to inquire if they had considered using electricity. If the answer was in any way favorable, a card was made out, giving the name and address of the prospective patron, and turned in to our office, whereupon our salesman called and did his utmost to supplement the work of the children with arguments on the advantages and cost of installing wiring and fixtures in the home. We thought that we could trust the youngsters to make a success of anything involving a dollar of spending—or saving—money, and so it proved. In all, eighty such names were received, of which 12 per cent were turned to contracts.

Discounts to the Customer for "Leads"

Another inducement that we utilized with good success was that after the new consumer had had his house wired under our schedule of prices he had the privilege of submitting to us as many names of "prospects" as he could collect or desired to suggest. Our salesman then called on these people, and for each contract se-





THE EVENING REPORT, LEBANON, PA., OCTOBER 7, 1913. PAGE SEVEN.

BY CO-OPERATION

With 3 Of The Leading Contractors

We Offer a Special Inducement in Way of An Exceedingly Low Price To Make THAT Hope and Desire of Yours Come True.

A Complete Modern Electric Epuipment In Your Home and at a Price You Can Afford to Pay!

Whoever has stepped into a house completely fitted with electric lighting without at once appreciating its superior beauty and convenience? Perhaps YOU have pictured your own home equipped in like manner, and almost ENVIED the comfort and satisfaction of it all.

But—"It costs too much" you have said "I can't afford it."

BUT YOU CAN AFFORD IT. Now by taking advantage of the co-operation plan—as the three Contractors of this city have for a short period agreed to purchase all material jointly in large quantities thereby earning larger discounts than heretofore, thereby enabling them to do housewiring at a very low figure.

Figure out what it would cost you to WIRE YOUR HOME at an average COST OF

$4.50 PER ROOM

Complete, ready to light, including Underwriters inspection, and we can guarantee that your bill for electricity WILL NOT EXCEED

$1.00 PER MONTH

A Word to the Wise

Every time an unwired house is rented or sold the owner sacrifices a big slice of his price. He can't fool people into paying the cost of a modern house when the house isn't modern, and the term "Modern" has come to mean ELECTRIC light no less than furnace and plumbing.

LOOK

Don't lay down this paper and say to yourself "That's a good advertisement and I'll have to take up the lighting proposition SOME DAY." Convince us that it is a good advertisement and call us up by phone—NOW—not some day next week or next month.

"DO IT ELECTRICALLY"

READ THIS—Actual Time Two Minutes

Selling an unwired house is like selling a horse with one blind eye. . . . when the purchaser sees the blemish he shakes his head and says—"Well how much do you want for this old skate?" . . . So if you have houses for rent or sale, don't let everybody discover a blind eye and bid you down.

Lebanon Electric Co.
24 NORTH NINTH STREET
BELL 72 W. COM. 201.

Electric Utility Co.
40 SOUTH EIGHTH STREET
BELL 748

Bender & Schropp
900 CUMBERLAND STREET
BELL 55 M.

EDISON ELECTRIC ILLUMINATING CO., PHONES: BELL 100 COM. 224 **742 Cumb. St.**

SOME OF THE HUGE GLASS-BALL SIGNS WHICH WERE FEATURES OF THE LEBANON (PA.) HOUSE-WIRING CAMPAIGN, AND A PAGE NEWSPAPER ADVERTISEMENT ADDRESSED TO THE OWNERS OF UNWIRED PROPERTY

cured from the names turned over to us by the new customer this consumer received a 5 per cent discount on the price of wiring his house, regardless of what it amounted to. In other words, if his house wiring cost $175, and we secured twenty consumers from the list of names he gave us, he received his wiring free of charge.

This proved quite an influence, for newly acquired customers are so pleased with the possibilities and advantages of electricity that they naturally talk about it to their friends and neighbors, and the added incentive of a reward made them an excellent advertising medium. We secured 150 names in this way, and they brought us thirty additional house-wiring contracts. The expense of these discounts was paid by the contractors alone, and they were very well satisfied with the proposition. As a further auxiliary concession, we allowed a special 10 per cent discount for cash on all wiring contracts secured during the first fifteen days. Of the fifty-two house-wiring contracts received there was only one customer who asked for time payments.

With only three salesmen taking care of commercial and residence business, we secured fifty-two old-house wiring contracts, no contract being for less than $40 and several figuring around $150. From information we have secured, we understand that the smaller contractors in the city, who number about four and did not participate in this campaign, secured more than thirty house-wiring jobs which were due indirectly to our advertising and the resultant general interest.

Altogether, we feel that our venture was a success, and that we have made a very gratifying forward step in the great work of educating our own people to "Do it electrically."

The Co-operative Public Skating Rink at Honesdale, Pa.

BY J. M. WALSH

The ice-skating craze so widespread this winter has led the citizens of Honesdale, Pa., to flood and freeze the city's Central Park in order to create a suitable rink for lovers of the sport. The Honesdale Consolidated Heat, Light & Power Company took an active interest in the movement to obtain a community skating place and is furnishing the lighting for the arena free of charge during the skating season. The ice surface of the rink was formed by banking snow 12 in. high around the border of the park and impounding water in the shallow basin thus made. The local street department furnished the labor necessary for this work and also flooded the inclosure. The park includes an entire city block and contains a number of well-placed shade trees which serve admirably as supports for the eight 1000-watt gas-filled tungsten lamps used to light the rink, making the scene decidedly attractive by night. No admission charge is made, and the increased popularity of the lighting company as the result of its public-spirited work has well repaid the efforts of the company's commercial department in promoting it.

A Window Display for Washington's Birthday

The show window which by appropriate dress keeps pace with events and seasons gains and holds the attention of the passing public. The display pictured herewith shows how the Edison Electric Illuminating Company of Brooklyn last February took the birthday of the nation's first President as its motif and, enlarging upon the idea, built up a patriotic window. In addition to the flags and bunting, an engraving of Washington was used to decorate the window, and the less

A PATRIOTIC WINDOW FOR THE MONTH OF FEBRUARY

evident connection between electric heating appliances and the father of his country was indicated by a card which read: "If George Washington were alive to-day, many good friends would send him electrical devices for birthday remembrances. Isn't there some one to whom you should send a coffee percolator or toaster or tea samovar this month?"

Electric-Lighted Flag Campaign Spreads to Residences

The remarkable wave of interest in electric-lighted flag signs which, as already recounted in these columns, has swept those cities and towns of the Middle West where flag-sign campaigns have been inaugurated by the local central-station sales organizations has spread from business buildings, factories, shops, schools, etc., to even the private residences of patriotic citizens.

At Toledo, Ohio, where the "flag idea" has had perhaps its largest development, R. A. Stranahan, who owns a beautiful home on the outskirts of the city, has installed an electric flag on his second-story porch so that it can be seen from all directions. At Denver, Col., also, Dr. L. E. Lemen, a leading physician, has followed the example with an electric flag sign on his house.

In several of these flag campaigns, conducted under the auspices of the Doherty properties, a 4-ft. flag containing 94 to 200 lamps has been standardized for production and sale in large numbers. Complete with lamps, color caps, etc., the selling-price of such a ninety-four-lamp sign is $75, and it is estimated that the sign can be operated at an average energy cost of 6 cents per hour.

Perpetuating the Prosperity Week Message

Shortly after the close of Electrical Prosperity Week the Merchants' Heat & Light Company of Indianapolis, Ind., prepared for distribution among its friends and patrons a booklet which summarized the local events of importance. The pamphlet opened with the following foreword: "To those of our friends who were unable to join us in the glorious celebration of Electrical Prosperity Week we are tendering this little brochure to carry to you personally our message of 'service first,' giving efficiency, economy and courtesy." Then followed reproductions of the company's local newspaper advertising, photographs of buildings flood-lighted for the first time during that week, and a view of the company's electrical-appliance exhibit, featuring "Service, efficiency and courtesy," the central-station slogan.

Persistence and Courage in the Salesman

The qualifications of the successful salesman were outlined by T. L. Barnes, sales manager of the insulated-wire department of the B. F. Goodrich Company, Akron, Ohio, in a talk before the commercial men of the Ohio Electric Light Association.

The salesman must reflect the policy of the company he represents, and must be able to inspire the confidence of the people with whom he deals, declared the speaker. Moreover, the successful salesman must have a thorough knowledge of the article or product he is selling, for an incomplete answer may be interpreted as an evasion of facts. The peculiarities of each customer must be studied before interviewing him. Probable questions must be mapped out and answers provided. The salesman must not misrepresent facts, and he should not leave a customer with an indefinite understanding.

Above all things, the salesman should not make a "black list" of customers who are hard to approach, and interview only those who are easy to sell to. After a territory has been thoroughly canvassed it is time enough to consider what persons are unprofitable to approach. Fear must never be present in the salesman's mind, because the apprehensive man is beaten before he starts. Persistent effort and courage are absolutely essential to success.

Record Year for Electric Appliance Sales at Denver

The Denver Gas & Electric Light Company during 1915 sold 9218 electrical appliances.

The sales of all appliances, according to William J. Barker, general manager of the company, showed a splendid increase, but the best record was probably that of the electric irons, 4851 being sold in 1915, as against 3124 in 1914—an approximate increase of 50 per cent.

The appliances sales in detail were as follows:

Irons	4,851
Toasters	1,597
Curling irons	355
Warming pads	302
Percolators	738
Heaters	227
Stoves	458
Cleaners	236
Lamps	139
Fans	158
Miscellaneous: Kettles, sewing-machine motors, washing machines, etc., etc	157
Total	9,218

During the six weeks preceding Christmas more than 2100 appliances, aggregating 1050 kw., were sold by a special crew of thirty salesmen secured through local newspaper advertisements and trained for the task of household demonstration by Milton Henoch of the Westinghouse sales organization. None of these salesmen-to-be had had any previous experience in central-station work. Instruction was given them in the form of evening lectures, illustrated with blackboard sketches and with demonstrations of the devices themselves. Each man was equipped with a black traveling bag, cards, and samples of the standard 6-lb. electric iron, the toaster stove, percolator, heating pad and the curling iron.

Consumers were prepared for the advent of these salesmen by announcements sent out in advance informing them that demonstrators would call, exhibit and explain these devices in their homes. Accompanying each announcement was an elaborate Christmas suggestion folder, containing illustrations and prices.

As the campaign progressed the men who proved themselves poor salesmen were gradually weeded out, until the personnel was as perfect as possible under the rather unusual conditions. The following figures testify to the efficiency of the sales force:

First Week.—Total sales were 295 pieces, amounting to $1,330.50, representing a load of 129,688 watts.

Second Week—226 pieces; $1,042.65; 106,933 watts.

Third Week—331 pieces; $1,469; 141,838 watts.

Fourth Week—347 pieces; $1,507.05; 158,659 watts.

Fifth Week—485 pieces; $2,228; 213,966 watts.

Encouraged by the success of the first five weeks for which the campaign had been planned, it was considered advisable to continue the work another week, bringing it up to Dec. 24. The results of this extra week justified all expectations as follows:

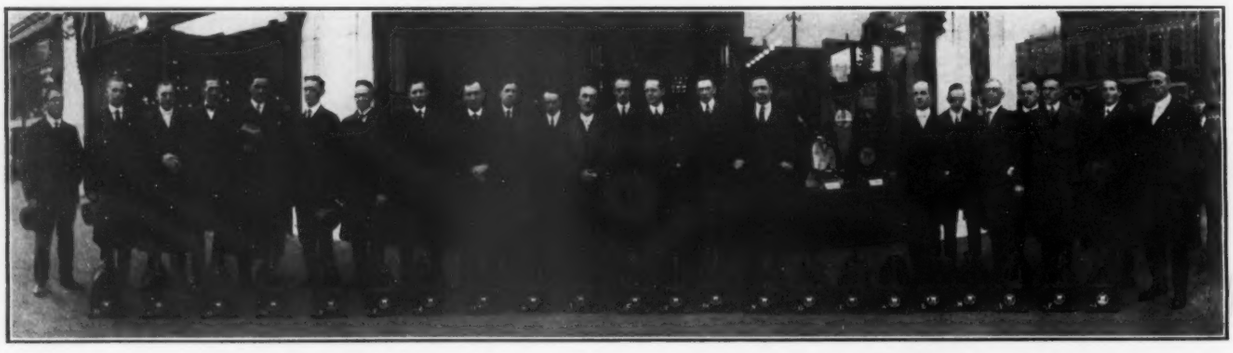
Sixth Week—478 pieces; $2,122.55; 212,569 watts.

The total wattage connected during the campaign approximated practically 1050 kw.

The method of exhibiting the devices in the home of the consumer, and there explaining and demonstrating their uses, together with the cost of operation, was proved to be a vital factor in making sales.

Although more than 800 irons were sold in the Denver territory, a peculiar fact brought out by the campaign was that other devices ran two to one against the irons, seeming to indicate that the saturation point had been more nearly reached with respect to irons than to the other devices. The campaign also demonstrated that there is a desire and a demand for the toaster-stove, percolator and numerous other devices which central stations as a rule do not canvass for.

The Denver Gas & Electric Light Company co-operated actively during the entire campaign by advertisements in the newspapers and street cars, and the entire local field was given over to the Westinghouse company to develop business during this period, with the understanding that the men should confine their sales strictly to Westinghouse goods. Where "prospects" for other products materialized, such as washing machines, vacuum cleaners, etc., their names were turned over to the regular solicitors of the Denver Gas & Electric Light Company to close, and a number of additional orders were taken from this source.



THE SALES CREW WHICH MADE HOUSE-TO-HOUSE DEMONSTRATIONS IN THE CHRISTMAS CAMPAIGN AT DENVER

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Fixation of Atmospheric Nitrogen as a Factor of National Defense

To Make the United States Independent of Chilean Saltpeter Importations, Fixation of Atmospheric Nitrogen Is a Necessity—The Three Commercial Fixation Methods

FOR fertilizers, as well as for explosives, nitrates and nitric acid are fundamentally important. As long as Chilean saltpeter can be freely imported there will be no trouble. But if for some reason these imports should be cut off—for instance, in time of war—one of the most fundamental raw materials for explosive as well as fertilizer manufacture would be unavailable. Germany has solved this very problem in the present war by producing the immense quantities of nitric acid needed for ammunition from atmospheric air. Germany was well prepared for this, as it had large plants for atmospheric nitrogen fixation which could be turned from fertilizer manufacture to ammunition manufacture. It is very evident that the self-containedness of any nation that has depended in the past on Chilean saltpeter alone requires that it take atmospheric nitrogen fixation into most serious consideration on a sufficiently large peace scale to facilitate the solution of any war problem that could arise.

The Naval Consulting Board at its last meeting in New York attacked this problem with characteristic foresight and vigor. Through its sub-committee on ordnance and explosives it recommended that the government of the United States erect at least one unit for the synthetic manufacture of nitrates and nitric acid, so as to get at least one plant, however small, in which to learn methods of production on a commercial scale. This unit would make it possible to train a staff of competent engineers and chemists to acquire the necessary experience and to provide means so that in time of war other units could be added in a relatively short time. The plans, drawings and specifications would be prepared in advance for such an emergency, and the initial staff would be able to train additional men for the work.

THE THREE COMMERCIAL PROCESSES

In view of this situation a concise review of atmospheric nitrogen fixation should be of interest. Atmospheric air is essentially a mixture (*not* a chemical compound) of 80 per cent by volume of nitrogen and 20 per cent of oxygen. Elementary nitrogen as contained in air is inert and practically useless, while nitrogen compounds are of great commercial and industrial value. As there are various useful nitrogen compounds, there are various fixation processes possible. Three have become of great commercial importance; for the present we may distinguish them as the direct-combustion process, the synthetic-ammonia process, and the cyanamide process.

The direct-combustion process is the simplest one imaginable. It takes the air just as it is and by sending electric discharges through it (sparks or arcs which produce temporarily an intense temperature in a limited zone of action) the oxygen and nitrogen are forced to combine. The result is a dilute mixture of nitrogen oxide gas in air. By rather laborious processes this is then worked up into nitric acid. The first investigators to try such a process were Bradley and Lovejoy at Niagara Falls, but it was not a commercial success, as the power cost, even at Niagara, was too high. They used a rotating wheel carrying one set of electrodes which continuously passed along an opposite and stationary set of electrodes, so as to cause and break continuously a great many sparks. All other later processes use, not sparks, but arcs, which greatly simplifies the mechanical construction. Birkeland and Eyde use arc disks produced by deviating arcs magnetically by means of a single-phase field. Schoenherr uses a very long alternating-current arc around which the air moves in a helical path. Pauling uses electric discharges quite similar to those obtained in horn lightning arresters.

The greatest success with these "direct-combustion" processes has been attained in Scandinavia, where the Birkeland-Eyde process is used and power is three or four times cheaper than at Niagara. The Pauling process is used in two plants in Tyrol and France. A small plant in the South operated by a subsidiary of the Southern Power Company and using the Pauling process is the only representative of these processes in this country.

This group of processes is the only one in which the air is used as raw material just as it is. In all other fixation processes the nitrogen is first separated from the oxygen in the air. Various processes for this purpose are possible and are in use. One of the simplest is liquefying the air, followed by fractional distillation.

The synthetic-ammonia process of Haber starts with nitrogen gas and hydrogen gas as raw materials (the hydrogen gas being produced, for instance, by electrolysis of water) and produces directly ammonia. The process is carried out, not at a very high temperature, but at an unusually high atmospheric pressure. A catalytic agent is used. The process has been in industrial use on a large scale for the past few years in Germany. The ammonia produced went, before the war, into the fertilizer field, and had to compete chiefly with ammonia from by-product coke ovens.

The cyanamide process starts with calcium carbide (produced in the electric furnace) and nitrogen gas as raw materials. In an electric furnace reaction calcium cyanamide, $CaCN_2$, is produced, which has chiefly gone into the fertilizer field. The process has been in use for a number of years in many European countries and at Niagara Falls on the Canadian side.

At first sight it would seem that while all these groups of processes start from atmospheric air, they are little interrelated commercially as far as their end products—nitric acid, ammonia, cyanamide—are concerned. That this would be a wrong conclusion was brought out forcibly in a very interesting paper presented by W. S. Landis before the American Institute of Chemical Engineers at the Baltimore meeting last month and published in the issue of Jan. 15 of *Metallurgical and Chemical Engineering*. This paper deals with the production of ammonia from cyanamide, and gives technical details and figures of cost. The process is simple: on treating lime nitrogen with steam, ammonia is produced according to the reaction: $CaCN_2 + 3H_2O = CaCO_3 + 2NH_3$.

In this way the cyanamide process enters into competition with the synthetic-ammonia process.

Even more important from the viewpoint of preparedness for war is the further fact that a process for converting the ammonia into nitric acid is now in use in Germany on a very large scale. While no details of this process have been published, it is known that it is different from the Ostwald process, which serves the same purpose. According to Mr. Landis, "Germany is producing at the present time enormous quantities of nitric acid from this cyanamide-ammonia by a newly developed oxidation process, and is erecting cyanamide plants equipped with ammonia apparatus at various places." A small plant of this kind is in experimental operation in the East in this country.

The whole development is another triumph of electrochemistry. This latest stage of atmospheric nitrogen fixation processes may be summed up in the statement that nitric acid may be produced in any of these three ways—first, by direct-combustion methods by the Birkeland-Eyde or Pauling process; second, by the Haber synthetic-ammonia process, followed by conversion of the ammonia into nitric acid; third, by the cyanamide process, followed by conversion of the cyanamide into ammonia and of the ammonia into nitric acid. As to the important question of relative costs, no exact figures are yet available, but costs cut a small figure in war times and in a preparedness program.

Generators, Motors and Transformers

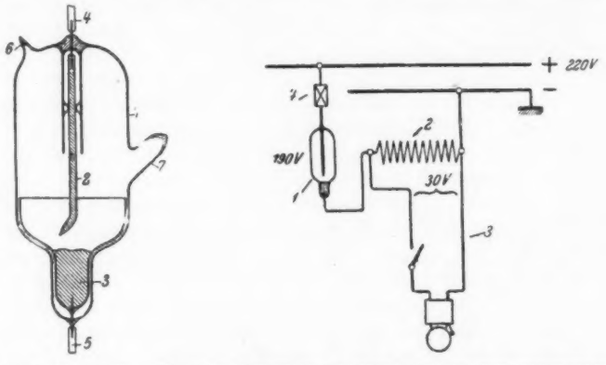
Dispersion Coefficient.—E. A. BIEDERMANN.—The conclusion of his long mathematical paper on the estimation of the dispersion coefficient of three-phase induction motors and its application to their design. In order to get a small dispersion coefficient it is first necessary that the air-gap should be as small as mechanically feasible. A second requirement is as small a slot pitch as possible. The two factors, slot pitch and gap ratio, have about equal importance. In small machines the slot pitch tends to have the greater influence, while in large machines the gap ratio becomes rather the more important, but the difference is in any case slight. Given the slot pitch and certain other quantities, fixed by various considerations, there is a definite diameter for the stator of the motor which will insure its having the least possible dispersion coefficient. This diameter may be departed from considerably without causing much increase in the dispersion coefficient, though it is better, if possible, for certain reasons, to select a value for the diameter not differing much from the one obtained for the ideal diameter.—London *Electrician*, Jan. 7, 1916.

Generation, Transmission and Distribution

Water-Power in Russia.—P. GUREWITCH.—In European Russia alone (including Finland, Ural and Caucasia) the available water-power is roughly 10,000,000 kw. (equal to 13,400,000 hp.), yet Russia's water-power is less developed than in any other country in Europe. The total rating of the water-power plants in Russia amounted in 1910 to hardly 250,000 hp. About 80 per cent of these plants had only a capacity of some 10 hp. to supply flour mills, sawmills, small factories, farm equipments, etc., the generating machinery being mostly of a primitive character. Lately, however, a tendency to change from the primitive waterwheels to the more perfect turbines is noticeable. A discussion of the different Russian water-powers is given, together with a map. The important problem of exploiting Finland water-powers for supplying the district of Petrograd with electrical energy is discussed.—London *Electrician*, Jan. 7, 1916.

Installations, Systems and Appliances

Taking Direct Current for Telephone and Signal Circuits from Commercial Lighting Networks.—FRITZ SCHROETER.—There is a very large field where primary batteries are used at present (for operating bells, telephone systems, signal systems, etc.), to which the use of commercial lighting circuits could be extended if it were possible to reduce the voltage properly in a convenient manner. With alternating current this is easy with small transformers, so-called "reductors." For direct current the author recommends the use of vacuum tubes in the form in which they have already been used as lightning arresters for the protection of telephone lines. They are Geissler tubes, and in their ordinary form they are effective down to 300 volts. The author has formerly described a modified form, effective down to 150 volts and less, in which a negative electrode of potassium or sodium is used in an atmosphere of argon, helium or neon at a pressure of 1 mm. to 3 mm. These rare gases are now comparatively inexpensive by-products of the industry of liquefying air. (These vacuum tubes were described in the Digest of the ELECTRICAL WORLD for March 27, 1915.) If a tube of this kind is connected across a line of 220 volts in series with an adjustable resistance and if the latter is of several thousand ohms, a brush discharge ("Glimmentladung") takes place through the tube, the current being small



FIGS. 1 AND 2—ARRANGEMENT OF VACUUM TUBES FOR REDUCING VOLTAGE ON BRANCH CIRCUITS

and the voltage at the terminals of the tube high, 100 volts or above. This is caused by the fact that at the cathode alone there is a voltage drop of 85 volts to 150 volts. The following figures show how the voltage at the terminals of the tube depends on the current through the tube with a cathode of potassium in an atmosphere of a mixture of neon and helium:

Volts	Milliamperes
100	1.8 (brush discharge)
108	5.6
115	10.5
128	47.0
139	76.1
31	175.0 (arc)

When the current arises above a certain value the discharge becomes an arc. A tube of this kind is shown in Fig. 1, in which 1 is a vacuum tube, 2 is an iron wire anode, 3 the alkali amalgam cathode, 4 and 5 the connections for the circuit. It will be seen that according to the value of the series resistance the vacuum tube has a very different resistance. The latter is high for a brush discharge and very low for an arc. If, as shown in Fig. 2, such a tube 1 in series with the resistance 2 is connected across the outer conductor and the earthed middle wire of a commercial 220-volt direct-current system, a bell or telephone or signal system may be connected to the terminals of the series resistance 2. If the dimensions of the vacuum tube are

correctly chosen, the voltage consumed in the vacuum tube may be, say, 190 volts, so that the voltage at the terminals of the resistance 2, or the voltage available for the bell or telephone system, is 30 volts. The no-load current consumption is very low. The article is to be concluded.—*Elek. Zeit.*, Dec. 23, 1915.

Traction

Electric Railways.—H. M. HOBART.—The second installment of his James Forrest lecture before the (British) Institution of Civil Engineers. The discussion of the Butte, Anaconda & Pacific Railway is concluded, and the author begins to deal with the Chicago, Milwaukee & St. Paul 3000-volt electrification. The paper is to be concluded.—London *Electrician*, Jan. 7, 1916.

Giovi Line.—The conclusion of the illustrated article on electric traction on the Giovi line. Auxiliary apparatus are described, especially the controlling mechanism for starting and regulating the power taken by the motors. The power plant at Chiappella has a total rating of 10,000 kw. There are two generating sets, each consisting of a 5000-kw. steam turbine coupled directly to a three-phase alternator and an exciter. Current is generated at 13,000 volts and sixteen and two-thirds cycles.—London *Electrician*, Jan. 7, 1916.

Electrophysics and Magnetism

Velocity of Electrons Expelled by Roentgen Rays.—C. G. BARKLA AND G. SHEARER.—If the electrons in the corpuscular radiation from substance exposed to X-radiation were ejected under the same conditions as those ejected by ultra-violet light, the experiments of A. L. Hughes would lead us to expect well-marked differences in the velocities from various substances. Careful experiments show that these differences do not exist. The maximum velocity of ejection does not depend upon the particular substance from which the electron is ejected. The K and L electrons ejected from a particular substance under the action of X-rays, though those electrons are different in origin and in association, are emitted with approximately the same velocity. —*Philos. Mag.*, December, 1915.

Electrochemistry and Batteries

Amalgam Concentration Cells.—GILBERT N. LEWIS.—A brief abstract of an American Physical Society paper. The accepted statement that electromotive forces can occur in completely metallic circuits only when different parts of the circuit are at different temperatures is true only when no process involving a diminution in free energy accompanies the transfer of electricity. This is not the case when two amalgams of different concentration are adjacent portions of the electrical circuit. Experiments made in the author's laboratory by Dr. Adams and Miss Lanman show that a measurable transfer of the dissolved metal accompanies the passage of the current through an amalgam. From such measurements can be calculated the potential of a concentration cell composed of two amalgams of the same metal in contact and connected by platinum wires. The potential thus calculated proves to be an easily measurable quantity, and its experimental determinations for a number of amalgams will, it is hoped, afford a means of finding the concentration of electrons in pure mercury.—*Phys. Review*, December, 1915.

Units, Measurements and Instruments

Origin of British Measures of Length.—SIR CHARLES M. WATSON, in a recent lecture at the Royal Society of Arts, pointed out that English measures are no haphazard modern invention but have survived from prehistoric times. The English inch is equal in length to three barleycorns set end to end, or in width to eight barleycorns set side by side. The inch on a carpenter's rule is still divided into eighths, and the shoemaker's tape is divided into thirds. The measures were:

3 barleycorns	= 1 inch	12 palms	= 1 yard
3 inches	= 1 palm	11 cubits	= 1 perch
4 palms	= 1 foot	405 cubits	= 1 cable's length
6 palms	= 1 cubit		

The lecturer pointed out also that the division of the circle into 360 deg. has never been improved upon. He considers the English units most convenient and thinks the adoption of the metric system would assist foreign trade competitors.—London *Electrician*, Jan. 7, 1916.

Oxide Resistance Thermometer.—S. L. BROWN.—A brief abstract of an American Physical Society paper. The rapid variation of resistance of the metallic oxides with temperature has been utilized to measure temperature. The greatest obstacle in the use of the oxide resistance thermometer is the difficulty in making electrical connections to the oxides. Heretofore connections have been made by clamping wires against the ends of the oxide resistance element. The author now makes electrical contact by brazing; that is, a small globule of the molten oxide and the molten ends of the wires are brought into contact and allowed to cool. If good connections are made in this manner, a very satisfactory resistance thermometer can be had which will have a resistance of only 50 ohms to 100 ohms at room temperature, but the resistance will be nearly doubled if its temperature is reduced to ice-point. Frequently thermometers made in this manner will have many thousand ohms resistance. In all probability poor connection to the wires accounts for this high resistance. The high-resistance thermometers have variable resistances depending on the strength of the current sent through them. Heat produced at poor contact would decrease the resistance, and hence the element would have lower resistance for higher currents. Such a high-resistance element makes a very satisfactory and sensitive thermometer if used at constant current. Temperatures may be recorded in terms of the resistance, which must be added in series with the thermometer in order to keep a constant current, which is furnished by a constant-voltage supply. A temperature change of 20 deg. C. may cause a resistance change of 15,000 or 20,000 ohms in such a thermometer.—*Phys. Review*, December, 1915.

Radiation Pyrometer.—S. L. BROWN.—An abstract of an American Physical Society paper on a modified radiation pyrometer. The plan in this instrument is to replace the thermo-junction of the Féry radiation pyrometer with an oxide resistance element. The radiation from the hot body whose temperature is to be measured is focused, by means of a concave mirror, on a very small and thin oxide element. This element is connected in series with a constant-voltage battery and a high-resistance millivoltmeter. The current, as indicated by the deflection of the millivoltmeter, is a measure of the temperature of the body whose radiation is focused on the high-resistance oxide element. The instrument may be adapted to any temperature interval by shunting the millivoltmeter with the proper resistance. For example, a temperature change from 1600 deg. to 2100 deg. Fahr. may cause a deflection of the millivoltmeter from 50 to 125 with a particular shunt, while this same district of the millivoltmeter scale may correspond to temperatures below 1600 deg. Fahr. when a higher resistance shunt is used.—*Phys. Review*, December, 1915.

Miscellaneous

Technical Education.—An abstract of the annual report on the work of the technology department of the City and Guilds of London Institute, with special reference to the training in electrical subjects.—London *Electrician*, Jan. 7, 1916.

A. J. BEMIS

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. J. Bemis has been appointed general manager of the St. Cloud Public Service Company, the Union Power Company and the Light & Power Company, all of St. Cloud, Minn., and will hereafter make his headquarters in that city in charge of the above A. G. Whitney interests. The St. Cloud Public Service Company controls the electric, gas and street-railway properties in St. Cloud and Sauk Rapids, while the other two companies operate public-service properties in about twenty neighboring towns. Mr. Bemis still retains his connection as supervising general manager of the Vicksburg Light & Traction Company Vicksburg, Miss., and the Mineral Point Public Service Company at Mineral Point, Wis., and will also continue to act as consulting engineer for the banking interests with which he has been associated.

Stephen G. Thompson, who has been the general electric-vehicle representative of the Public Service Electric Company, with headquarters at Newark, N. J., has been appointed factory representative and special transportation engineer for the White Motor Car Company, Cleveland, Ohio.

H. H. Barter, who designed and installed the electric lighting of the Panama-California Exposition at San Diego, Cal., and for the last ten months of 1915 was director of works of the Exposition, has just been appointed director of the technical department at Universal City, the great motion-picture production plant near Los Angeles. Mr. Barter is a graduate of the University of Illinois at Champaign. Upon going West after graduation he was engaged in engineering work for the Stone & Webster interests for seven years, handling both steam power and hydroelectric work. In 1909 he planned and installed the electric distributing system on the grounds of the Alaska-Yukon Pacific Exposition at Seattle.

R. S. Huntington, the senior member of the new firm of Huntington & Guerry, electrical engineers and contractors for mill, power and lighting plants, Greenville, S. C., is a graduate of Pratt Institute, Brooklyn, N. Y., class of 1902. After experience in the Schenectady and Pittsfield factories of the General Electric Company, Mr. Huntington went to the Atlanta office of the company as a foreman of construction in the engineering department, taking part in this connection in several important power and industrial developments in the South. In 1913 Mr. Huntington opened an office at Atlanta as a contractor for large power and lighting equipments, and early in 1915 he moved his headquarters to Greenville, S. C., to specialize in textile-mill work.

Victor H. Tousley, the new president of the Electric Club-Jovian League of Chicago, is chief electrical inspector in charge of the electrical inspection department of the city of Chicago. Just a year ago Mr. Tousley was elected president of the Chicago Jovian League, and upon the consolidation of that body with the Electric Club he was appointed acting vice-president of the combined organization. Mr. Tousley is a graduate of the 1897 class of the Armour Institute of Technology. He joined the Chicago bureau of electrical inspection in 1901, was appointed assistant chief inspector in 1907, and became chief inspector in 1910. Mr. Tousley has been a close student of electrical construction methods and is a past-president of the Western Associa-

V. H. TOUSLEY

tion of Electrical Inspectors. He is also a member of the electrical committee of the National Fire Protection Association. With H. C. Horstmann Mr. Tousley is the author of a number of books on wiring.

Dr. L. H. Baekeland, inventor of synthetic insulating materials, was awarded the Perkins Medal for eminence in industrial chemical research at a meeting of the Society of Chemical Industry at New York, Jan. 21. Dr. Baekeland is a member of the Naval Consulting Board and is a past-president of the American Institute of Chemical Engineers. He is well known among electrical men for his production of bakelite, and in the photographic field by his invention of Velox paper. Dr. Baekeland was born in Belgium and in 1884 received the degree of doctor of science from the University of Ghent. Later he studied at Charlottenburg, Germany, and in 1889 he came to the United States, where he has been engaged successively in his work on photographic paper, on a commercial process for manufacturing caustic soda, and on the production of benzylmethylenglycolanhydride, the insulating compound to which the commercial name of bakelite has been given.

DR. L. H. BAEKELAND

Obituary

Frank H. Varney, manager of the steam-electric department of the Pacific Gas & Electric Company, San Francisco, Cal., died in that city Jan. 21, after an illness of several months. Mr. Varney, who was forty-three years of age, was born in San Francisco and received his early training in that city. When the San Francisco Gas & Electric Company became a part of the Pacific Gas & Electric Company Mr. Varney was placed in charge of the steam-electric section of the operation and maintenance department, having under his immediate supervision the extensive system of electric plants in the San Francisco Bay district, Sacramento and San José. Mr. Varney was well known for the energy with which he organized the work under his direction, —the department he controlled was marked "100 per cent efficient" in the company competition. At the time of his death Mr. Varney was presiding officer of the Pacific Service Section of the N. E. L. A. and was an active member of the A. S. M. E., the A. I. E. E., and the Engineers' Club of San Francisco. At the funeral services the pallbearers were John A. Britton, George C. Holberton, P. M. Downing, W. S. Hyde and C. A. Eastwood, representing the Pacific Gas & Electric Company; C. R. Weymouth, representing C. C. Moore & Company; E. O. Shreve, representing the General Electric Company, and Frederic Gay, representing the J. G. White Company.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Electric Furnaces for Producing Refined-Steel Products

The use of electric furnaces for the production of steel castings of superior quality, high-grade steel alloys for use on automobiles, aeroplanes, etc., and tool steel has increased during the past year until the United States now stands first in the making of electric steel, taking the place held by Germany a year ago. According to statistics compiled by the *Iron Age* during 1915 the number of electric furnaces in the steel industry increased from forty-one in this country and two in Canada to seventy-three in this country and eight in Canada, or eighty-one in both countries, an increase of thirty-eight furnaces, or over 88 per cent. The total number of electric furnaces now in use throughout the world has increased from 213 to 303, a gain of ninety furnaces, or 42.3 per cent, the greater number of which are installed in the United States. Of the various types of furnaces, the Heroult arc furnace has shown the greatest increase, there being over forty sets in the United States alone, with a total production placed at 1,470,350 tons a year. Other types employed in this country in the manufacture of steel are the Snyder, Wile, Rennerfelt, Stassano, Gronwal and Girod furnaces.

Electric furnaces are especially well adapted for making steel because of the fact that heat is generated without the contamination of oxidizing conditions and because materials with objectionable ingredients can be refined, giving a steel of high quality. Castings made from steel produced in electric furnaces are desirable on account of their solidity and freedom from blowholes. So well can oxidizing gases be excluded from the bath, it is claimed, that metal even better than crucible steel can be produced. Electric steel is particularly in demand for large-sized castings, such as car couplers, where quality is the first consideration. Electric furnaces are also being utilized to refine cupola iron for making malleable castings, and various munition manufacturers are using them in ever-growing numbers for making high-grade steel for projectiles.

In the accompanying illustrations are shown two types of Girod furnaces, that illustrated in Fig. 1 being a 12-ton furnace employed in the plant of the Compagnie des Forges et Aciéries Electriques, Paul Girod, Ugine, Savoy, France, and that shown in Fig. 2 a 2-ton set employed by Oehler & Company, Aarau, Switzerland. The Girod electric furnace is a hearth furnace formed by a rectangular or circular iron shell and lined with refractory material. The furnace is fitted with a sliding door, through which the furnace is charged and slag is removed. Opposite the door is a tap hole. The arched roof is of silica brick with metal framework.

Energy is supplied by carbon electrodes hanging vertically into the furnace, the lower ends being near the slag level. In the bottom of the furnace, and as far away as possible from the upper carbon electrodes, are six or more steel electrodes which pass through the refractory bottom and are in direct connection with the furnace shell and the low-tension side of the power plant. The steel electrodes are water-cooled. The steel frame is placed on rollers so that it can be tilted forward for the tapping or backward for the removing of the slag, which is done through the charging door. Since there is only one door, easy access to the furnace

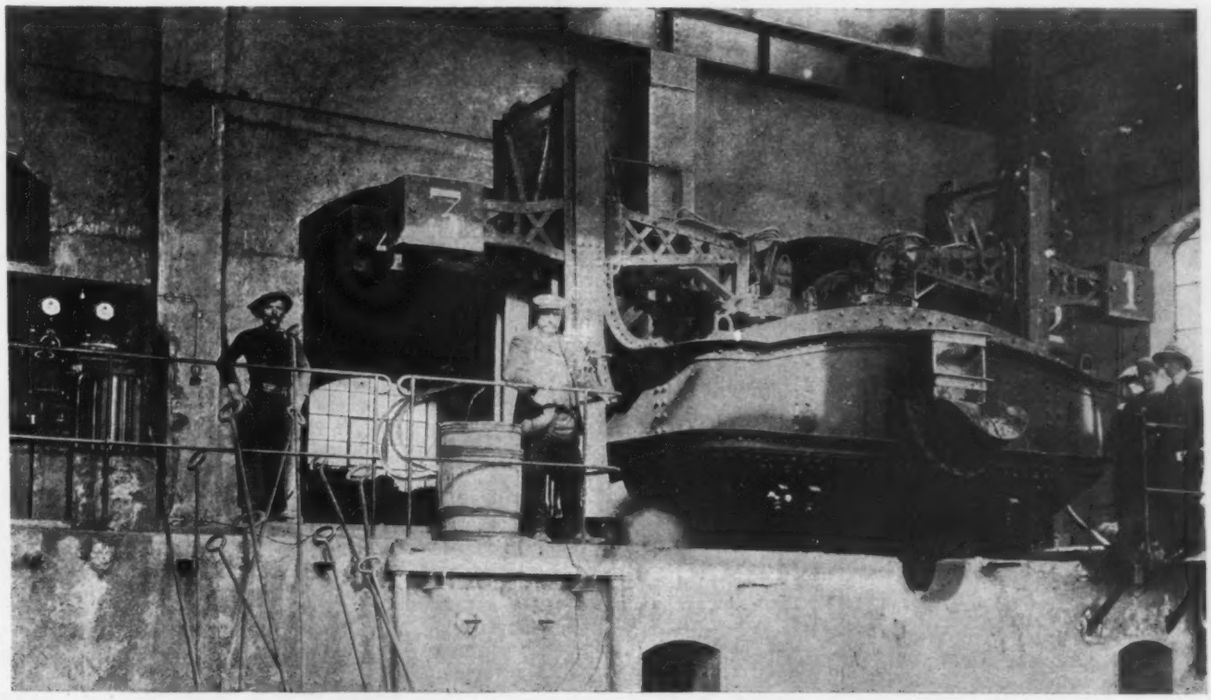


FIG. 1—TWELVE-TON ELECTRICALLY OPERATED GIROD FURNACE EMPLOYED IN PLANT IN SAVOY, FRANCE

is assured and the entrance of too much air is prevented. The furnace is tilted by means of an electric motor or hydraulic plunger.

The 2-ton to 3-ton furnaces operate preferably with single-phase, twenty-five-cycle, 70-volt current, which will give a power-factor above 0.80. When using single-phase energy, only one upper carbon electrode is required. Furnaces with capacities of 4 tons up to 25 tons per heat are usually operated with three-phase current and any number of cycles up to sixty. A higher power-factor is obtained, however, with a lower number of cycles. The 2-ton to 3-ton furnaces are equipped with one 700-kva. transformer, the 5-ton to 6-ton furnaces with three 475-kva. transformers, the 10-ton to 12-ton furnaces with three 750-kva. transformers, and the 20-ton furnace with three 1000-kva. transformers. It is usually preferable to install transformers of large rating so as to heat the charges in as short a time as possible.

At the works of Gutehoffnungshütte, Germany, a 3-ton Girod electric furnace is employed for refining molten steel from a 25-ton open-hearth furnace. The single-phase energy for this furnace is furnished by a motor-generator set consisting of a 3000-volt, 95-amp., 575-hp., three-phase induction motor (with a power-factor of 0.92) and a single-phase, 75-volt, 6700-amp., twenty-five-cycle, 500-kw. generator (with a power-factor of 0.8) with exciter unit. The well-known firm of Krupp & Company of Essen, Germany, is working a 15-ton Girod furnace which is utilized in the production of special steel for war materials. This concern is also installing a 5-ton furnace which is to be used for the melting of ferromanganese, the manganese loss being reduced, it is claimed, by an electric furnace. The following are concerns which are using or installing the Girod electric furnaces in this country: Bethlehem Steel Company, South Bethlehem, Pa.; Simonds Manufacturing Company, Lockport, N. Y.; Washington Iron Works, Seattle, Washington, and Electric Steel Foundry, Portland, Ore. The Girod electric furnace is being placed on the market in the United States by C. W. Leavitt & Company, 30 Church Street, New York City.

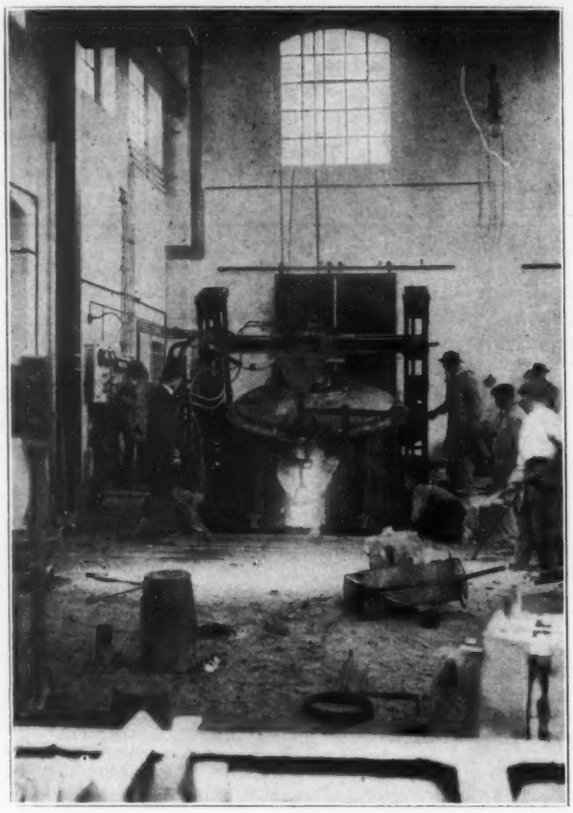
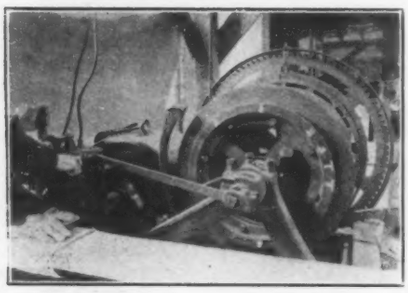


FIG. 2—TWO-TON ELECTRIC FURNACE IN SWITZERLAND PLANT

Electric Drive for Contractors' Machinery

The electric motor is being used more extensively every year for operating contractors' machinery, such as hoists, concrete mixers, pumps, air compressors, shovels, and the like. As a result of a study of this field, the Westinghouse Electric & Manufacturing Company is building a line of motors especially adapted for contractors' use. Their special features are ruggedness and strength to withstand hard usage. Motors for hoists, concrete mixers and shovels may be totally inclosed if desired. The machines are designed to produce considerable power within limited dimensions, especially in starting, where the demand for power is greatest. The speed is adjustable, and the motors can be stopped and reversed almost instantly without injury. The extensive use of electric power in such operations as the building of the Panama Canal and the Catskill Aqueduct proves its desirability for large work, while it is also advantageous for small operations.

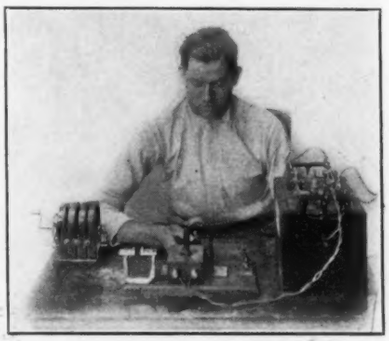
The motor-driven hoist shown in the accompanying illustration, the photograph of which was secured with difficulty owing to the limited space, is on the sidewalk at Fifth Avenue and Fourteenth Street, New York City, where it is used in connection with repairs to a building. This is typical of the many uses to which the electric-motor hoist is applicable where the steam hoist would be unsuitable.



MOTOR-DRIVEN HOIST ON SIDEWALK

Remagnetizer for Automobile Magnetos

Owing to the fact that frequently trouble in automobile ignition systems can be traced to weak magnets in magnetos, devices for recharging the magnets are especially useful to automobilists. The "Treco" magnet charger, as it is called, shown herewith, can be operated on an ordinary 6-volt storage battery, on five or six dry cells, or from a storage-battery-charging outfit. The outfit consists of a charger, charging board, polarity indicator, switch, conducting cords and attachments for magnetizing Ford magnetos without taking out the magnets. The device is simple in operation and economical in use. Three or four applications of current on each leg of the magnet are sufficient to bring any magnet, it is declared, up to the "full saturation point." The remagnetizer is being placed on the market by the Townsan-Remington Electric Company, Fort Worth, Tex.



REMAGNETIZING DEVICE FOR AUTOMOBILE MAGNETO MAGNETS

Single-Phase Induction-Repulsion Motors

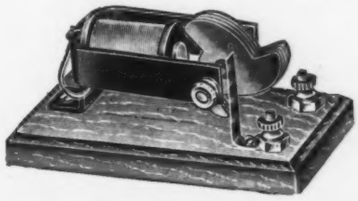
Type I-R motors of the single-phase induction-repulsion type, equipped with simple and accessible short-circuiting devices, are being marketed by the Emerson Electric Manufacturing

ALTERNATING-CURRENT MOTOR WITH SIMPLE SHORT-CIRCUITING DEVICE

Company, 2024 Washington Avenue, St. Louis, Mo. The fields of the machines, which are of the repulsion-start type, consist of steel laminations. A noteworthy feature of these machines, according to the manufacturer, is the small number of parts. These parts include an armature with commutator and shaft, a rocker arm with two brushes and holders, a retaining collar for segments, a ring of short-circuiting segments, a spring to hold retaining collar, an adjusting nut and a cotter pin. In service the retaining collar surrounds the small end of the short-circuiting segments. At starting centrifugal force causes the segments to fly out, thus short-circuiting the commutator so that the brushes do not carry energy. The motors have been designed to start under 100 per cent overload and on two and one-half times full-load running current, and while running to have a capacity of 100 per cent temporary overloads.

Toy Motor

The "Monocoil one-mouse-power" motor, as it is called, shown herewith, embodies an unusual principle in toy motors, namely, a rotating armature without windings. The energy consumption is said to be low and the power developed comparatively great on one dry cell, while with two or three cells in series sufficient motive force is provided for running any toy,



SMALL MOTOR FOR OPERATING TOYS

it is declared, such as "Meccanno" or "Mysto" sets. The construction of the device is very simple; therefore, according to the manufacturer, there is nothing to get out of order. This interesting little device is placed on the market by the C. D. Wood Electric Company, 136 Liberty Street, New York.

Curve-Recording and Curve-Analyzing Devices

Among the recent developments of instruments for studying engineering problems are the polar oscillograph attachment, for recording curves, shown in Fig. 2, and the harmonic analyzer, for analyzing curves, shown in Fig. 1. These devices are designed for use in obtaining quick and accurate analysis of any periodic wave, such as the current or voltage wave of a motor, generator or power system. It has been customary for a long time to regard current and voltage values as vector quantities and use these trigonometric relations to express the various phase relations. This procedure, however, is only correct when the waves of current or voltage are sine values. When these waves are distorted large errors may result by making these assumptions. The only positive method, therefore, of

FIG. 1—CURVE-ANALYZING DEVICE

solving such problems, it is declared, is to obtain an actual analysis of the wave by means of an adequate analyzing device such as the harmonic analyzer previously referred to.

The polar oscillograph attachment used to obtain a polar oscillogram of the wave which is to be analyzed is shown in Fig. 2. This attachment can be used interchangeably with the regular rectangular film holder on the standard oscillograph. The oscillogram is made on a photographic film about 10 in. in diameter and is then printed on a sensitized piece of bristol board, from which a templet is cut for use on the analyzer. Fig. 2 shows the analyzer, which has been designed to give any one harmonic at a time, odd or even, as high as the fiftieth. The method of analyzing is simple and entirely mechanical. Although the operation of the machine is based on the Fourier theorem, the actual procedure for analyzing can be performed by a person with no knowledge of the mathematics involved. Selecting the proper gears, turning the crank and reading the planimeter are the only operations required. The device can be applied to electrical problems of wave shapes of generators and problems arising from the paralleling of generators or from cross-currents in machines or trans-

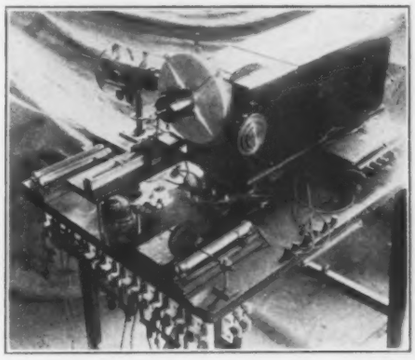


FIG. 2—DEVICE FOR RECORDING CURVES

former connections. The use of the analyzer, however, is not limited to electrical problems. Any periodic wave, such as sound waves, waves of magnetic flux and torque curves of gas engines, can be analyzed and the related waves derived by simple mathematical transformation.

Both devices, it is asserted, will prove to be valuable additions to any standard oscillograph equipment. The case and the metal parts of the analyzer are well finished, so that the instrument has an attractive appearance and fits in very well with other instruments in a well-equipped laboratory. They are being manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and received a bronze medal at the Panama-Pacific Exposition.

Washing-Machine Motor

The motor shown herewith is of special design and has been developed by the Robbins & Myers Company, Springfield, Ohio, for washing-machine service. The end heads are cast in the form of louvers which are said to

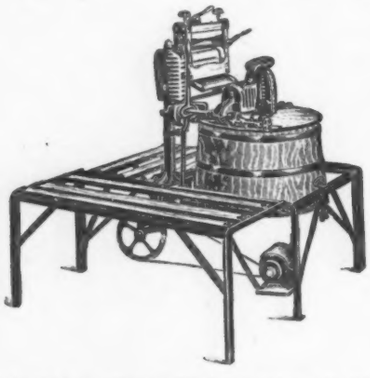
MOTOR DESIGNED FOR WASHING-MACHINE SERVICE

give absolute protection from water that may splash on the motor casing, while at the same time permitting free circulation of air through the motor. Ventilation is further enhanced by a fan connected to the shaft. The base of the machine is cast separately from the motor frame, to which it is at-

tached by four screws. It may also be attached to the top of the motor, permitting overhead mounting when so desired without making it necessary to turn the motor over and invert the end heads. The motor terminals are protected by an iron box which fits over them and is held in place by two screws. The cord enters this box through a hole provided with a rubber bushing. The motor is equipped with 10 ft. of reinforced cord and a separable attachment plug. It is also fitted with a V-groove pulley. Use is made of bearings of phosphor bronze which are lubricated by wick oilers. The lubricating system is so constructed as to prevent any leakage of lubricant which might soil the clothing. The motor is being made for use with direct current of all standard voltages and alternating current of all standard frequencies and voltages. The machine operates at 1750 r.p.m. on direct current and 60-cycle alternating current.

Electric-Driven Vacuum-Type Washer

A motor-driven washer which is equipped with a funnel-shaped dasher designed for washing without damaging the most fragile fabrics is shown herewith. No pegs are employed, and the perforations in the cone are smooth, so that they will not tear the clothes. The dasher rotates and reverses uniformly and automatically with each stroke, thereby keeping the clothes free from tangle. The tub is of Louisiana



ELECTRIC WASHER WITH FUNNEL-SHAPED DASHER

red cypress and is mounted on a platform frame of angle steel, the left or supplementary half of which is removable in order to economize space between washdays. The platform is of hardwood strips bolted to the metal. In addition to supporting the washer, the platform is designed to hold a tub of rinsing water, a tub of bluing water and a basket. Use is made of a reversible wringer which can be swung and locked in any position desired. A quick lever-release is provided, and by a single movement of the reverse lever the wringer can be run in either direction or the entire machine brought to a dead stop. This lever is situated in the center of the machine and is always in convenient reach of the operator. The tub gearing is controlled by a hand wheel on the top of the lid, and the wringer by a lever always convenient to the right hand. The washer is driven by an 0.35-hp. motor which is connected to the machine by a grooved pulley and which operates at 1800 r.p.m. Power is transmitted from a 2-in. pulley to the grooved pulley on the machine, which has a diameter of 10 in., reducing the speed on the drive pulley to approximately 365 r.p.m. The washer is being made by the Wayne Manufacturing Company, St. Louis, Mo.

Electric Coffee Percolator

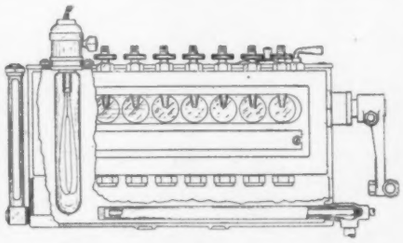
A handsome type of coffee-making machine, designated by its maker as the "American Beauty" percolator, is shown herewith. The device has a ca-

NICKEL-PLATED COFFEE PERCOLATOR

pacity of six cups of coffee, which it prepares quickly, the manufacturer points out. The percolator is finished in polished nickel and is rated at 350 watts. The American Electrical Heater Company, Detroit, Mich., is the maker of this coffee percolator.

Electrically Heated Lubricator

In the accomanying illustration is shown a method of heating lubricators by a low-efficiency incandescent bunghole lamp devised by the Richardson-Phenix Company, Milwaukee, Wis. The lamp is supported in a moisture-proof socket from the lubricator tank cover. It is usually employed with lubricators

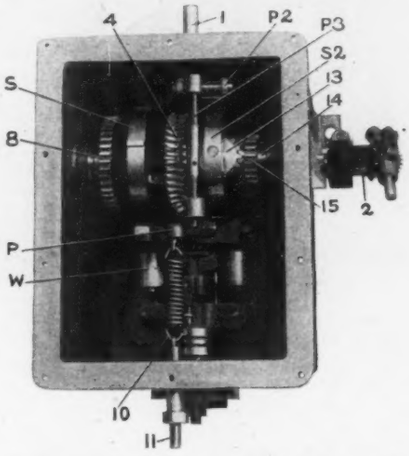


LUBRICATOR HEATED BY AN INCANDESCENT LAMP

used on gas engines, and is utilized only when very heavy oil is employed or where the lubricators are so placed that they are subject to cold drafts. The oil is heated only slightly to keep it in a fluid state.

Double-Acting Power and Speed Regulating Controllers

The Speed Controller Company, 259 William Street, New York, has brought out a new automatic double-acting precision governor, as it is called, which



INTERIOR VIEW OF DOUBLE-ACTING CONTROLLER

is a speed controller of the centrifugal governor type and is similar in several respects to the single-acting controller described in the ELECTRICAL WORLD of Oct. 24, 1914. In the accompanying illustration is shown an interior view of the oil-retaining case with cover removed.

The shaft 1 of the controller carries the governor parts and a steel worm and is connected to the shaft of the machine providing the power. The secondary shaft 2 carries differential gearing, and is connected to the device or means of adjustment, which may be, for instance, a valve or rheostat. A predetermined speed of the apparatus to be controlled is adjusted for in the tension of spring 10. The width of the "neutral zone" in which no adjustment is made may be as large or small as desired by the adjustment of the link *P*3.

When placed in operation the primary shaft and its connected parts revolve continuously, and while running in the neutral zone the two differentials operate idly upon the secondary shaft. All parts, being in continuous motion and in a state of exact balance, are ready at all times to respond to changes in velocity of the primary shaft without lost motion. At the normal speed for which spring 10 may have been set there will be no adjustment at the secondary shaft, it is pointed out, but when the speed varies 0.5 per cent on either side of the "neutral" a positive connection is established between the primary shaft, through one or the other of the differentials, and the secondary shaft. The secondary shaft is thereby caused to rotate to effect either an increase or a decrease of speed as required, and to continue its motion, it is stated, until the speed for which it is adjusted shall have again been reached.

Directly Connected Electric Ventilators

Disk or propeller fans, directly connected to motors as shown in the accompanying illustrations and designed for removing large quantities of air

FIG. 1—VERTICAL-SHAFT VENTILATING FAN

under light pressures, are being made by B. F. Perkins & Sons, Holyoke, Mass. The fans are generally installed in an outside wall or ceiling, driving the air from the interior and discharging it into the open atmosphere. Under certain conditions they can also be utilized in connection with piping systems, if the pipes are made of the proper size and kept free from sharp bends. Directly connected fans of the type shown can be installed, the manufacturer points out, where they are wanted without regard to their relation to any line shaft or previous driving arrangement, and they can be controlled from a switch placed any distance away or wherever most convenient to operate. In Fig. 1 is shown a vertical-shaft fan outfit which is useful where a vertical movement of air is required. The fan which is shown in Fig. 2 is designed for use where it is desirable to build the fan into a brick or cement wall. The fans are built of steel throughout. The direct-current outfits include regulating rheostats which will reduce the speed 50 per cent from normal. The single-phase alternating-current outfits include resistance-reactance starting boxes with no-voltage-release devices. The direct-current fans are built in sizes of 18 in. to 48 in. and are operated by motors varying in rating from 0.2 hp. to 2 hp. The alternating-current fans are built in sizes from 18 in. to 48 in. and are operated by motors varying in rating from 0.2 hp. to 2 hp.

FIG. 2—FAN FOR BRICK OR CEMENT WALL

All-Metal Electric Washer

The electric washing machine shown in the accompanying illustration and manufactured by the Modern Laundry Machine Company, Kansas City, Mo., is of metal construction throughout, rendering it, the maker points out, strong and rigid, light in weight, easy to clean and durable. The tank is of heavy sheet metal, double-seamed and soldered, and is water-tight and rust-proof. The cylinder is made of heavy galvanized steel and the frame of steel angles, rigidly braced and double-riveted. A standard Westinghouse small motor is employed to operate both the washer and the wringer. All gears in the operating mechanism of the washer and between the washer and the wringer run at slow speed in hard oil

LIGHT-WEIGHT MOTOR-DRIVEN WASHER

contained in grease-proof cases. A gas burner is provided under the tank for heating the water. All operations are controlled by two small levers at the side of the machine. Use is also made of a safety device on the wringer for safeguarding the operator and the mechanism from injury. The capacity of the cylinder is sufficient, it is claimed, to care for the needs of the ordinary family.

Vapor-Proof Lighting Fixture

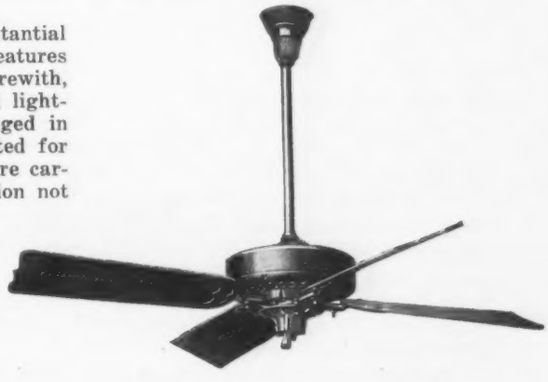
Simplicity of parts and substantial mechanical construction are the features claimed for the fixture shown herewith, which is designed for industrial lighting with tungsten lamps arranged in multiple. It is especially adapted for use in plants where processes are carried on requiring perfect isolation not only of the lamp but of accessory parts on account of the presence of explosives, volatile liquids, inflammable gases, corrosive fumes, steam and moisture. The fixture is designed for use with lamps of the nitrogen-filled type with ratings up to 100 watts, equipped with medium-screw bases. Use is made of a strong, heavily galvanized cast fitting, threaded for 0.5-in. conduits, which is securely riveted from below to a canopy or socket housing formed in one piece with a 15-in. porcelain-enamaled steel reflector, an asbestos washer being inserted between the two parts to make a tight joint and prevent abrasion of the enamel in wind stress. For use immediately over vats with dense acid fumes a solid aluminum casting is substituted for the galvanized fitting. A screw thread is cut into the canopy before enameling and a vapor-proof globe with a threaded collar is screwed into the canopy with an asbestos gasket to seal the joints. The fixture is equipped with a medium-screw-base porcelain socket, which is readily accessible for wiring and is firmly secured inside the canopy to prevent turning as the lamp is screwed in or out. The fixture is being placed on the market by the Wheeler Reflector Company, 156 Pearl Street, Boston, Mass.

VAPOR-PROOF INDUSTRIAL LIGHTING FIXTURE

Ceiling Fans

Two new types of ceiling fans have recently been placed on the market by the Western Electric Company, 463 West Street, New York. One of these fans, which is shown herewith, is equipped with adjustable blades for "breeze control." A rod extending down from the base of the fan terminates in a pear-shaped handle, and with this rod the blades of the fan can be so adjusted that any desired volume of breeze can be secured. This is a simple and adequate method, it is claimed, of controlling the breeze from a ceiling fan and does away with rheostats.

The other model is provided with an indirect-lighting unit attached from below, so that it gives both ventilation and light. A very attractive combination is obtained by attaching the ornamental fixture to the fan in this way. Both these fans will find wide application, it is pointed out, in hospitals, public institutions, restaurants, etc.



CEILING FAN WITH ADJUSTABLE BLADES

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Civils May Join United Engineering Society

Ballots were sent out this week to the members of the American Society of Civil Engineers in order that they may vote on the invitation of the United Engineering Society to their society to become a founder member and to relinquish its present home on West Fifty-seventh Street, New York City, and take up permanent headquarters at the Engineering Societies Building. The ballots will be counted on June 15.

Action on the matter has been pending since the official invitation of the United Engineering Society, which was transmitted on June 28, 1915. Two propositions are submitted to the civil-engineering body the acceptance and fulfillment of either of which will make it a founder society on an equality with the present three founder societies, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers, and will make the value of its interest equal to that of the present founder societies, namely, $650,000. By the first proposition the civil engineers shall erect for their use two additional stories on the top of the Engineering Societies Building at a cost to them not to exceed $250,000. By the second proposition the civil engineers shall take for their future home one floor of the Engineering Societies Building and pay into the treasury of the United Engineering Society the same amount that the present founder societies paid in the beginning, namely, $244,000.

Inspectors Pass Wire Recommendations

Aside from the session at which concentric wiring was discussed, the meetings of the Western Association of Electrical Inspectors at Chicago, Jan. 25, 26 and 27, were occupied largely with routine matters. Discussion of the following topics created casual interest: Grounded fixtures, inclosing of live parts, gas-filled lamps, fixtures and wiring, safeguarding electrical hazards in garage wiring, organ wiring, 1916 National Electrical Code rules, use of distinctive marker for neutral wire, and automatic substations. The reports of the following committees were read and returned to the committees for further investigation: Architects' specifications, traction properties, installation and operation of induction motors, electric signs, and theater wiring.

The report of the committee on rubber-covered wire, of which V. H. Tousley of Chicago is chairman, was adopted, together with the following resolution:

"Be it resolved, first, that the Underwriters' Laboratories be requested to furnish copies of this report to all manufacturers of rubber-covered wires and cords in the United States and Canada and to urge upon all such the discontinuance of the manufacture of 'old code' wires and cords for light, heat or power purposes when same are to be used within the United States or Canada; and, furthermore, that the Underwriters' Laboratories be requested to keep this association informed as to the effectiveness of such efforts;

"Second, that (a) all rubber-covered wires or cords designed for light, heat or power purposes be provided with a distinctive marker so that they may be easily identified in the field; or (b) all rubber-covered wires or cords designed for purposes other than light, heat or power be provided with a distinctive marker so that they may be easily identified in the field;

"Third, provided that if the recommendation in paragraph two is found to be impracticable, all rubber-covered wires or cords designed for purposees other than light, heat or power be so labeled that the purpose for which they are manufactured shall be plainly shown on the label;

"Fourth, that the use of flexible cord having 1/64-in. rubber insulation be investigated with a view to discontinuing its approval;

"Fifth, that the use of the words 'old code' be discontinued for the reason that these words carry with them an implication of recognition by the National Electric Code and thus tend to continue in use this class of wire for electric-lighting purposes, while as a matter of fact the wire designated by this title is not made according to any standard and is not recognized in any way by the code;

"Sixth, that every inspector of this association use his best effort to stamp out the use of sub-standard wires and cords in the territory covered by the association."

At one of the business sessions a new constitution for the association was adopted and officers were elected.

Massachusetts Electricians' License Law

Herbert A. Dallas, clerk of the Massachusetts Board of Electrical Examiners, appeared before the legislative committee on mercantile affairs last week in advocacy of strengthening the license law of 1915, basing his recommendations upon experience with the act since its adoption last summer. The act requires master and journeymen electrical workers to procure State licenses, and Mr. Dallas contended that the definition of "master electrician" should be made more explicit, and pointed out that the expression "for hire" in connection with the employment of journeymen has been taken to mean that anyone not employed by a master was authorized to do wiring on his own account. Special certificates were recommended for fixture hangers, moving-picture operators and steam engineers who may be required to do minor work in connection with lighting systems. Student apprentices also should have special certificates, the speaker urged.

Mr. Dallas also said that the present law does not stipulate clearly enough that it is the duty of the local wiring inspector to follow up the attempts of unlicensed workmen to install wiring and equipment. A. J. Hixon of Boston, president of the Electrical Contractors' Association of Massachusetts, favored the foregoing amendments, and the point was made that in many small towns the absence of local wiring inspectors makes it difficult to safeguard the public from the work of unlicensed installers. Frederick Manley Ives, for the Massachusetts Electric and Gas Association, favored the amendments and suggested that they be formulated by the legislative committee on public lighting.

Public Service Commission News

Maryland Commission

Testing facilities and voltage variation were the principal topics taken up at the first day's session of the conference between representatives of Maryland light and power companies and the Maryland Public Service Commission. It is proposed to require, according to the rules which were prepared by Chief Engineer Phelps of the commission, that each utility company shall after May 1, 1916, provide portable indicating voltmeters for testing voltage regulation and that each utility serving more than 250 consumers shall in addition provide one or more portable recording voltmeters giving a continuous record of not less than twenty-four hours' duration. The records made shall be preserved for the inspection of the commission. Testing equipment for service watt-hour meters, switchboard instruments, recording voltmeters and other electrical instruments in use must be provided by March 1 next. Reference standards of all kinds will be adjusted by the commission at least once a year.

It is proposed to test the voltage at the junction of the trunk line and the consumer's service line instead of at the service cut-off. In this way it will be found out whether there is sufficient copper to give the consumer proper service. There is a clause in the new rules also that insures continuous services. In this connection the "voltage variation" paragraph caused much discussion. This paragraph states:

"Each utility supplying a constant-potential service shall adopt standard supply voltage or voltages for its system or large division thereof, and every reasonable effort shall be made to maintain such voltage constant at all times during which service is supplied. The variations above or below standard voltage shall not exceed 6 per cent of such standard voltage at all times during lighting hours (lighting hours are those from about sunset to 11 p. m.). On power circuits and during other than lighting hours the voltage shall not vary at any time more than 8 per cent from the standard (except in the case of power supplied for electric-railway lines). In the case of special contracts for lighting or power service not connected with the principal distribution system of the utility, such service may be supplied under conditions of greater voltage variations when approved by the commission."

Meter and testing accuracy will be the first topic taken up at a further session, and then periodic and installation tests will be discussed.

Missouri Commission

In the case of the complaint of the Rhodes-Burford House-Furnishing Company and others against the Electric Light & Power Company, the points involved were, first, the custom of the lighting company in selecting rates for its patrons "based on observation," and, second, a finding by the Public Service Commission that complainants are entitled to the recovery of the amounts overpaid by them on account of the selection by defendant of an improper rate.

The commission denied its ability to order the return of alleged overcharges, claiming that this was a question for the courts to decide. In connection with rates on a demand basis, the commission in its order ruled as follows:

"The defendant shall, as soon as practicable, during the normal peak-demand period peculiar to each class of business, make an inspection of the installation of each customer of a class having the choice of more than one schedule, for the purpose of checking up his connected load, maximum or assessed demand or other conditions of use, and shall study the cousumer's monthly energy consumption for the past year and secure any other reasonable data necessary to determine whether the consumer is still being served under the most economical schedule then in effect, and to place the consumer under the existing schedule most advantageous. This shall not be required, however, where such an inspection has been made at the beginning or during the consumer's present term of agreement.

"If a new customer having the choice of a schedule based on measured maximum demand is placed on a schedule not based on measured maximum demand, or if the demand is temporarily obtained by assessment pending the determination of the measured demand, such schedule or such assessment shall prevail until the demand is actually measured, which shall be the next succeeding normal peak-demand period, and in case the consumer then elects to be placed under the demand schedule, or in case the actual measurement of demand effects a change in the consumer's account from that computed on the assessed demand, the consumer shall be credited with the excess or may be charged with the decrease accruing between the amount paid and the amount computed on the basis of the measured demand.

"When the defendant shall make an investigation of the customer's connected load and assessed or measured demand, together with a study of the consumer's monthly energy consumption, either at intervals or in connection with new business, the consumer shall then either be placed on the most advantageous schedule or advised of the result of the investigation and proffer made of the company's assistance in determining under which schedule consumer would be most benefited. The company shall not be required, however, to effect more than one change in schedule existing at time demand is measured or assessed in any twelve months' period.

"When defendant introduces an entirely new schedule of rates and charges which will possibly offer advantages to existing consumers, each consumer possibly so affected shall be furnished with notice of new schedule and proffer made of the company's assistance in determining whether consumer would be benefited by being served and billed under such schedule.

"If a customer, in accordance with any of the foregoing, shall elect to be placed on any other schedule than the one under which he is being served, he shall not be required to enter upon a service agreement extending beyond the time of expiration of the original agreement, unless compliance with the new agreement shall entail expense to the company for the installation of new apparatus or facilities for serving a customer, in which case the company may require the standard term of agreement before putting into effect the new schedule."

New York Commissions

Though abdicating none of its regulatory powers, the Public Service Commission for the Second District of New York has decided that it cannot assume the responsible functions of the managers of a corporation and pass on the business wisdom or unwisdom of the acts of a board of directors made in good faith and within the provisions of the law. The commission has denied the application of Marvin Schiebler to have revoked a previous authorization of the commission for an issue of $134,000 of bonds, with the proceeds of which the Suffolk Gas & Electric Light Company was to make extensions to its gas lines. Mr. Schiebler objected that the issue of these bonds jeopardized his equity in bonds of a previous three-hundred-and-fifty-thousand-dollar issue by this company, in that the later issue saddled the company with an unprofitable extension, for which it paid an excessive price through large profits to the E. L. Phillips Company, which did the construction work.

Sweden Prohibits Export of Carbons.—The Swedish government has prohibited the exportation as from Dec. 10 of carbon electrodes.

January Copper Production.—The production of refined copper in the United States during January has been estimated at 167,000,000 lb.

Japanese Hydroelectric Stations.—According to the Japanese statistics of the Ministry of Traffic, there are in Japan 383 hydroelectric stations, with a total estimated capacity of 2,172,000 hp.

German Authorities Not to Confiscate Copper Parts of Equipment at Present.—German authorities have announced that it is not intended at the present time to call in for confiscation copper parts of machinery equipment.

Oklahoma's Meter-Deposit "Baby Bonds" in Demand.—The coupon "baby bond" used by the Oklahoma Gas & Electric Company instead of the customary receipt for customers' deposits is having a large demand among the company's customers. The bonds referred to and the method of issuance were described in the ELECTRICAL WORLD of Nov. 6.

Tufts Radio Station Rebuilt.—The experiment station of the American Radio & Research Company at Tufts College has been completed and experiments have begun. The tower which will replace the one nearly completed that blew over last fall is over 300 ft. high, being the largest in New England and the third largest in the United States. It is supported on four specially designed porcelain insulators inserted in 15 tons of reinforced concrete. This station, as the name of the company indicates, will be devoted entirely to research problems in the wireless field.

British Institution to Waive Examination Regulations for Admission to Those Engaged in War Service.—Candidates for admission as associate members of the British Institution of Electrical Engineers who are engaged in naval or military service or employed in an engineering capacity in manufacture of munitions or other war work will be exempted from complying with the examination regulations, and any such service may be accepted in part fulfillment of the conditions laid down with regard to experience, provided that in other respects the candidate satisfies the necessary requirements as to age and training.

Remote-Control Lighthouse Station Successful.—Remote-control light and fog signal stations, equipped with 500-watt incandescent lamps in lens lanterns and with electric sirens, have been in successful operation on Angel Island, Cal., since Feb. 11, 1915, according to the report of the United States Bureau of Lighthouses. The controlling station is situated at the keeper's dwelling, about one mile distant from one station and about two miles from the other. An arrangement of relays in conjunction with a telephone enables the keeper at the control station to open and close the siren circuit and to listen to the operation of the fog signal through the medium of a single wire.

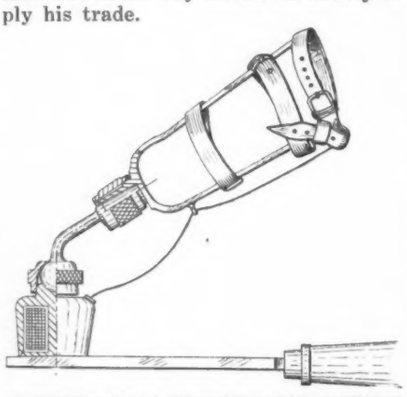
Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Bills Introduced by Kentucky Legislature to Regulate Energy Distribution.—Representative Webb of the Kentucky Legislature, now sitting at Frankfort, has introduced two bills which would regulate the manner of distributing electricity in the State and of laying mains and conduits in public roads and would otherwise regulate the distribution activities of electric utilities.

Having Plants in Two States Delays Power Company's Mortgage.—The granting of a privilege to the New Jersey Light & Power Company to issue a mortgage against its property, part of which is in Pennsylvania and part in New Jersey, is being delayed by the New Jersey Public Service Commission. It is contended that the property in Pennsylvania, being under the jurisdiction of the Pennsylvania commission, could not be mortgaged except with that board's consent.

Magnetic Hand for War Cripples.—The German nation, with its usual foresight, has already developed appliances which will enable those who have been crippled in the war to take their trades up again. One of these appliances is the magnetic hand, an illustration of which is shown below. The hand is provided with an armlet which straps over the stump of the arm, and it has a ball and socket joint, allowing freedom of movement. Energy is supplied to the holding magnet by a flexible cord from a small specially designed battery. The movement necessary to close the circuit and energize the magnet has all been carefully worked out and will depend to a large extent on the degree to which the soldier has been crippled. The "hand" shown below is holding a file, but can be made to perform almost any kind of useful work. As a further instance of the ingenuity of the device, planes have been fitted with iron plates so that if the soldier was a carpenter before the war the mere losing of an arm will in no way lessen his ability to ply his trade.



MAGNETIC HAND DESIGNED FOR CRIPPLED GERMAN SOLDIERS AND SAILORS

Lighting Utilities in Almost Half of Kansas Cities Municipally Owned.—Eighty-eight of the 166 cities in Kansas having electric service own their own plants.

Ottumwa Company Returns to Old Location.—The building formerly occupied by the Ottumwa (Iowa) Railway & Light Company, destroyed by fire in 1915, has been rebuilt and the company's offices have been re-established in the old location.

Nitrogen-Filled Lamps for Street Lighting in Victoria, B. C.—The gradual replacing of the ordinary tungsten lights with the new nitrogen-filled lamps at Victoria, B. C., will cut the cost of the street lighting 35 per cent, according to a report recently filed by the Victoria city electrician.

Consumption of Electricity in European Capitals.—P. Gorewitch in a recent issue of the *Electrician* of London gives the following statistics on the per capita consumption of electricity in the chief cities of Europe: Petrograd has thirty-eight consumers of electrical energy to every 1000 inhabitants, the five stations in that city delivering in 1913 125,000,000 kw.-hr. and the average rate received for lighting being 19.13 kopeks (10 cents). In 1911-12 Berlin consumed 170 kw.-hr. per inhabitant; in 1910-11 London consumed 110 kw.-hr., Vienna 72 kw.-hr., and Petrograd 64 kw.-hr. The per capita consumption of Chicago, it might be of interest to add, is more than 300 kw.-hr. and that of San Francisco 300 kw.-hr.

Tacoma Signs Contract for Supplementary Power.—Mayor Fawcett of Tacoma, Wash., has signed the power ordinance approving a contract by which the Tacoma Railway & Power Company agrees to furnish the city with 10,000 hp. of power to supplement the municipal plant whenever necessary. The company will now start at once making the connections between the city plant and the plants of the Puget Sound Traction, Light & Power Company, an affiliated company. The contract requires the power company to bear the cost of placing the apparatus necessary for the connection. The supplemental 10,000 hp. will insure the city, it is said, a minimum of 18,000 hp. and a maximum of 42,000 hp.

Connecticut Corporation Tax Law to Be Tested.—Test suits have been brought against the United Electric Light & Water Company of Waterbury, Conn., and the Fountain Water Company of Ansonia for non-payment of taxes under the terms of the corporation tax law, according to which water, gas, electric and water-power companies shall pay an annual tax upon gross earnings and operations in Connecticut, and no deduction shall be allowed from such gross earnings, nor any commission, rebate or other payment except a refund resulting from an error or overcharge. The tax charged is 1.5 per cent. The decision will affect some forty companies which have neglected to pay this tax. The tax is being fought on the ground that by taxing gross earnings expenses are also taxed.

Liability for Death Caused by Jerking Arc-Lamp Wire.—The New Orleans Railway & Light Company was held by the Supreme Court of Louisiana (70 So. 110) not to be liable for the death of a person of more than average height who met his death by reaching up and jerking a wire to brighten an arc light when that wire was purposely fastened out of ordinary reach.

Compensation in Condemnation Proceedings.—On the application of the Public Service Commission for the First District of New York to condemn land for a public improvement it was held by the Supreme Court (155 N. Y. S. 985) that the owner of the land is entitled to the true market value but not to an increased price due to the fact that the land is to be used for the public improvements.

Extent of Right to Appropriate Water.—The Supreme Court of Pennsylvania (95 A. 803) has held in the case of Rider versus York Haven Water & Power Company that a water company invested with the power of eminent domain can appropriate the water of a stream outside the limits of the district for which it was incorporated to supply the public in the territory where it has the right to transact business.

Necessity of Appeal to Commission Before the Courts.—In a case before the Supreme Court of New York State (156 N. Y. S. 151) on a petition to recover for illegal telephone rates, the plaintiff ignored the Public Service Commission of the State and brought its action directly in the courts. The court held, however, that recovery for illegal charges could not be obtained without an appeal to the commission, from whose decision, as discriminatory, the plaintiff could appeal to the courts.

Measure of Damages for Injury to Land. — A riparian owner whose land has been permanently injured by an unlawful diversion of water cannot elect to treat the trespass as of a transient character and sue for special damages, it was held by the Supreme Court of Pennsylvania (95 A. 803) in the case of Rider versus York Haven Water & Power Company. The measure for damages for permanent injury is the difference in the market value before and after injury unless the cost of removing the obstruction would be less, in which event the latter measure of damages should be adopted.

Right of City to Condemn That Portion of a Company's System Within Its Borders. — The Wisconsin Traction, Light, Heat & Power Company supplies service from its plant at Appleton to Menasha, and the latter municipality sought to condemn the company's property within the city's corporate limits. The Supreme Court of Wisconsin (155 N. W. 139) held that under the definition by statute of a public utility the property or plant of a public utility might consist of a part of the plant, and that the city could condemn therefore such part of the company's plant as was within its territory, since when it granted a franchise to the power company its grant constituted that company a public utility in the city.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Lighting Companies Not Bound to Inspect Customer's Appliances.—In a case against the Northumberland County Gas & Electric Company before the Supreme Court of Pennsylvania (96 A. 135) for damages arising out of a fire caused by a short-circuit where the service wires passed through the outer wall of a building it was held that a lighting company is not bound to inspect appliances owned and maintained by the customer, nor is it liable for damages from defect therein.

Duty to Warn of Present High-Tension Line.—A railroad company operating a power substation had agreed with a lighting company for the erection of a contiguous substation so that the same crew of employees might operate both and that the light companies might use one of the railroad's substation's walls as a wall of the new substation. The Supreme Court of Utah (153 N. W. 585) held that the railroad company thus licensed the light company's contractors to go upon its premises to remodel the wall, and was under a duty that could not be delegated to warn the contractors and their employees of the danger of the high-tension uninsulated electric wires on the roof of the railroad's substation. Parties maintaining electric uninsulated lines carrying high-tension current must exercise the necessary care and prudence to prevent injury to others who have the right to be on the premises where the wires are maintained.

Nature of Private and Public Utilities and Regulation.—Whether a corporation is private or public, it was held by the Supreme Court of Illinois (110 N. E. 334), is not to be decided from the number of persons in the enterprise for their mutual advantage, but from the terms of its charter and the general law under which it is organized. The diversion of streets and alleys from their legitimate use by constructing a telephone system thereon would not give the Public Utilities Commission jurisdiction over the association. Where a mutual telephone association has no authority under its charter to engage in public telephone service or to devote its property to public use, but is organized for the private use of its members only and not for profit, an order of the Public Utilities Commission requiring the association to cease operations for failure to obtain a certificate of convenience and necessity is void, since the jurisdiction of the commission is confined, by the terms of the act creating it, to control and supervision of owners and operators of property devoted to a public use.

Rights of Companies Supplying Electricity Where There Are Statutory Provisions.—It was held by the Appellate Division of the Supreme Court of New York in the case of Tismer vs. New York Edison Company (165 N. Y. S. 28) that while the transportation corporations law, if read literally, makes it the unqualified duty of light and power companies to furnish energy upon application, it is a company's right and duty to make reasonable rules and regulations to assure the sufficiency and safety of the equipment within the building to which the energy is to be supplied, and it was a reasonable condition of a contract between an electric-light company and an applicant for service that before energy was supplied this equipment should be approved by the constituted authorities and by the company. It was further held to be lawful and reasonable for an electric-light company to require that a party applying for service should furnish a certificate of the Board of Fire Underwriters as to the sufficiency and safety of his wiring and equipment, and it was immaterial that such board charged a fee of $2.50 for such certificate, as the company had a right to make its own inspection or to determine whose examination and approval would be satisfactory to it, and, if it made the inspection itself, was entitled to make a reasonable charge for such service.

Liability for Death by Shock Caused in the First Instance by Negligence of Another.—The Richmond (Ind.) Light, Heat & Power Company was sued for the death of a city electrical inspector who was electrocuted by a stray current caused as follows: The municipality and the lighting company were transmitting a 2200-volt primary current stepped down to 110 volts from the same poles. One of the light and power company's primaries was about 18 in. from one of the city's secondaries. A traction company's trolley wire was supported by cross-wires attached to these poles, which were small and not adapted to this strain. The vibration of the trolley wire pulled the tops of the poles to the east, causing the electric-light wires to rub against each other and also rub against the pole, thereby destroying the insulation. Although this happened six months prior to the electrocution, no action was taken to repair the damage, and it was while the decedent was inspecting some appliances in a house that the two wires again came together, causing the full 2200 volts to pass over the secondary circuit, with which he came in contact and was killed. The Supreme Court of Indiana held (110 N. E. 666) that while the immediate cause of the accident was the negligent act of the traction company, the electric-light company's negligence in permitting the dangerous condition to arise and continue was a proximate cause of the accident, and the complaint was not erring in stating a cause of action against the light company as failing to show that the contact of the wires resulted proximately from its negligence.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 351 of this number.

Illinois State Electrical Association.—The annual convention of the Illinois State Electrical Association will be held at the University of Illinois, Champaign, on Feb. 23.

Watthour Club.—George E. Druen, superintendent of the electrical department of the Suburban Fire Insurance Exchange, was the speaker on Jan. 26 at the meeting of the Watthour Club in Long Island City, N. Y.

Fort Wayne Section, A. I. E. E.—"Modern Automobile Tendencies" was the subject of an address on Jan. 20 by C. F. Kettering of the Dayton Engineering Laboratories Company before the Fort Wayne Section of the American Institute of Electrical Engineers.

Dayton Power & Light Section, N. E. L. A.—Members of the Dayton Power & Light Company Section of the National Electric Light Association met on Jan. 21 to listen to a lecture by Victor Jann on the 7500-kw. turbines installed in the Third Street power house of the company.

American Society of Mechanical Engineers.—On Feb. 8 T. Russell Robinson, statistical engineer for W. S. Barstow & Company, Inc., New York, will address the American Society of Mechanical Engineers at the Engineering Societies Building, New York City, on "Ways of Presenting Data for Executive Purposes."

Minneapolis Section, A. I. E. E.—The meeting of the Minneapolis Section of the American Institute of Electrical Engineers was held on Jan. 24 at the Elks' Club. A. L. Abbott, manager of the Electric Construction Company of St. Paul, read a paper on "Recent Developments in Illumination." Charles Clapper of the Toltz Engineering Company made an address.

Fourteenth Jovian Congress.—Reigning Jupiter Thomas A. Wynne has called a meeting of the fourteenth Jovian congress in conjunction with the quarterly meeting of the National Electrical Jobbers' Association in Detroit on Wednesday, Feb. 16, to convene at 6 p. m. Dinner will be followed by a business session at which plans and policies of the order will be discussed.

Pacific Service Section, N. E. L. A.—The Pacific Service Section of the N. E. L. A. held an "educational" meeting in San Francisco on Jan. 25 at which three papers were presented as follows: "Gas and Electric Heating of Buildings," by L. H. Galbraith; "Industrial and Gas Heating," by Charles Ross, and "The Relation of the Individual to the Electrical Industry as a Whole," by R. E. Fisher. Appropriate resolutions referring to the recent death of Frank H. Varney, presiding officer of the section, were adopted, and W. S. Coleman was elected as his successor.

New York Jovian League.—At the Jovian luncheon on Feb. 2 held at the Hotel Martinique, New York City, there was an important discussion of the advisability of organizing a new league to be called the Electrical and Jovian League of New York City. A form of constitution and by-laws which was drafted by a sub-committee consisting of J. R. Strong, J. M. Becker and J. H. Betts was submitted at the meeting for consideration. The new league, which will be formed for the purpose of encouraging and increasing the use of electricity in all its branches and for the active consideration of civic affairs, will have three kinds of membership—Jovian, non-Jovian and honorary. The reorganization of the local Jovian League has been made necessary by the lack of interest of its members and by the small attendance at the semi-monthly luncheons.

Boston Engineers' Annual Dinner.—With President Charles L. Edgar of the Boston Edison Company acting as toastmaster, the annual dinner of the engineering profession at Boston, Mass., will be held at the Boston City Club on the evening of Feb. 8. The presidents of the local and national engineering societies are expected to be present, and the program includes addresses by Col. W. E. Craighill, United States Engineers; William Barclay Parsons of New York, and Dr. John A. Brashear of Pittsburgh, Pa. The purpose of the gathering is to promote the professional and social relationships and stimulate broader civic interest in the engineering industry in New England.

National Electric Piano Makers' Organization Committee.—As the result of a movement which has been actively prosecuted for the last six months among the piano and music trades and the electric light and power and electrical manufacturing interests to further the commercial exploitation of player-pianos, talking machines and other electrically driven musical instruments, the National Electric Piano Makers' organization committee has been formed and will hold its preliminary meeting at the Engineering Societies Building, New York City, on Feb. 10. The National Electric Light Association has appointed a committee of three to attend the meetings of the new organization and to receive the suggestions and recommendations advanced by the piano and musical-instrument manufacturers.

Sales Activities of United Electric Light & Power Company.—At the regular monthly meeting of the United Electric Light & Power Company's Employees' Association on Feb. 2 in New York City Joseph F. Becker, sales manager of the United company, outlined the activities of the sales department in the past year, presenting data on growth of peak load, energy consumption and revenue, and compared different forms of advertising as to their cost and value. Frank W. Smith, vice-president of the company; H. W. Grove, assistant to the electrical engineer; T. I. Jones, general sales agent of the Edison Electric Illuminating Company of Brooklyn, and H. M. Edwards, auditor of the New York Edison Company, also spoke.

New York Section, American Electrochemical Society.—The New York Section of the American Electrochemical Society has arranged a symposium on "Electrochemical War Supplies" which it will hold jointly with the New York Section of the American Chemical Society and the Society of Chemical Industry at the Chemists' Club in New York City on Feb. 11. The program, which will emphasize the impetus the war has given the nation's electrochemical industries, will include: Lawrence Addicks on "Electrochemical War Supplies," W. F. Landis on "Air Saltpeter," E. D. Ardery of the United States Navy on "Hydrogen for Military Purposes," Albert H. Hooker on "New War Products," William M. Grosvenor on "Magnesium," G. Ornstein on "Liquid Chlorine," and George W. Sargent on "Electric Steel."

Conference of Station-Operating Men in Ohio.—The station-operating men of the Ohio Electric Light Association will meet on Feb. 16, under the direction of the station-operating committee, at the Chittenden Hotel, Columbus, Ohio. Following an address of welcome by W. A. Wolls, new-business manager of the Columbus Railway, Light & Power Company, William Long of the Toledo Railways & Light Company will present a paper entitled "Problems Arising in Station Operation." Discussion of this topic will be led by R. H. Feather of Columbus, C. A. Spiehler of Dayton, and L. C. Anderson of Middletown. At luncheon the delegates will be addressed by M. S. Hopkins, vice-president of the E. W. Clark Management Corporation. Thomas G. Coghlan, efficiency engineer of the American Gas & Electric Company, will speak on boiler-room economics, and Norman G. Reinicker, New York Edison Company, on boiler-room operation at the afternoon session.

February Meetings.—The following meetings are scheduled to be held during February: American Electric Railway Association at Chicago, Ill., on Feb. 4; National Electrical Contractors' Association at Richmond, Va., on Feb. 7 and 8; American Society of Mechanical Engineers, at the Engineering Societies Building, New York, on Feb. 8; midwinter convention of the American Institute of Electrical Engineers at the Engineering Societies Building on Feb. 8 and 9; midwinter convention of the Illuminating Engineering Society at the Engineering Societies Building on Feb. 10 and 11; New Mexico Electrical Association, annual convention, at the Alvarado Hotel, Albuquerque, on Feb. 14 to 16; operating section of the Ohio Electric Light Association at the Chittenden Hotel, Columbus, on Feb. 16; Electrical Supply Jobbers' Association at the Hotel Statler, Detroit, Mich., on Feb. 15 to 17; and the twenty-first quarterly meeting of the New York Electric Railway Association at the Ten Eyck Hotel, Albany, N. Y., on Feb. 24 and 25.

FINANCE, COMMERCE AND INDUSTRY

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Manufacturing and Industrial

Increase in the Demand for Storage Batteries

Since the first of last September the demand for storage batteries, which was never very poor, has been constantly increasing. Present business is excellent, and the outlook for the future is even more brilliant. The volume of buying has increased in every field that utilizes storage batteries, and particularly so in mine-locomotive and safety-lamp work, commercial-vehicle transportation and railroad equipment. Coal and iron mines were the largest purchasers of storage-battery mining equipment. In order to take care of the increasing consumption of both coal and iron, the mining activities in these commodities were extended considerably.

Owing primarily to a better co-operation between those interested in promoting electric-vehicle transportation and secondly to the high and steadily rising price of gasoline, commercial electric vehicles are having a wider sale to-day than they ever had. In the allied field, that of the industrial truck, the increase in battery sales has been conspicuous.

One of the features in the storage-battery business has been the buying by railroads. Starting in 1913, the railroads began to intrench and the purchasing of equipment was kept down to the minimum. This continued throughout 1914, but in 1915 the purse strings of the railroads were again open. Storage batteries provide the energy for the lighting equipment in modern passenger rolling stock, and any change in the equipment-purchasing program, therefore, registers its imprint on the storage-battery business. Storage batteries for central-station peak service are in large demand. Only recently was it announced that the largest storage battery in the country was contracted for by the Detroit Edison Company. It is expected that there will be considerable buying of batteries by the United States government.

In the pleasure field, both automobile and motorboat, the sale of batteries is practically regulated by the production of the vehicle. Since this year promises to be a record breaker for sales in both automobiles and motorboats, the storage-battery outlook in this direction is very gratifying to the manufacturers. It was pointed out, however, that this business was always increasing. Even in the past depression economies were made in necessities but seldom in luxuries. The sale of automobiles and motorboats was higher than ever.

Deliveries of batteries have not as yet been held up to an appreciable extent. The freight embargo on Eastern-bound consignments at one time was very threatening, and even now the inability of the railroads to supply rolling stock whenever and wherever needed is causing some slight delay in shipments. While the costs of the raw material have gone up materially, it has always been possible to obtain supplies without delay. There has been some shortage in skilled labor but nothing serious. For these reasons, and because the manufacturing plants are equipped to take care of a steadily increasing volume of orders, deliveries have not been lengthened.

No changes have occurred in price. In some directions it was thought that an increase would have to come shortly unless the prices of the raw materials stopped rising. Others, however, were of the opinion that prices would not advance but that any increased production cost in one direction would be taken care of by a more intensive drive for business in order to derive the benefits of the economies which are incident to quantity production.

Collections are excellent and becoming better. Credits are still subjected to a rigid examination.

Henry Exall Elrod, Dallas, Tex., an engineer, has been retained to design the water-works and the electric light and ice plant for the Citizens' Water, Light & Power Company of Lockhart, Tex.

The Davis-Brown Electric Company, 115 South Cayuga Street, Ithaca, N. Y., has appointed E. J. Williams sales manager. Mr. Williams was formerly connected with the Simplex Electric Heating Company.

The Loew Manufacturing Company, Cleveland, Ohio, manufacturer of gas engines, has purchased two pieces of land adjoining its plant at 9100 Madison Avenue, which will be utilized for an addition to its factory.

The Rowan Electric Manufacturing Company, Baltimore, Md., has moved from 208 North Holliday Street to 308 North Holliday Street. The new location will enable the company to take care of its large increase in business.

The Moloney Electric Company, St. Louis, Mo., has appointed R. B. Coleman, formerly of the Electric Machinery Company, as a traveling representative in the Chicago district. Mr. Coleman will cover the States of Iowa, Minnesota, Michigan and Wisconsin.

The Corwin Telephone Manufacturing Company, Lafayette, Ind., has recently been formed and is engaged in the manufacture of telephone appliances and various types of electrical devices. E. R. Corwin is president of the concern, and M. J. Corwin is secretary and treasurer.

J. C. Jones, 1302 South Columbia Street, Frankfort, Ind., has opened an electric shop which is provided with departments devoted to the sale of electric fixtures, general contracting, and repair of electric apparatus. Mr. Jones was formerly the chief senior member of Jones & Burk.

The Diehl Manufacturing Company, Elizabeth, N. J., has changed the location of three of its branch offices. The new addresses of these offices are as follows: New York office, Singer Building, 149 Broadway, room 916; Boston office, 201 Devonshire Street, room 234, and Chicago office, 1641 Edison Building.

Clarence W. Marsh has become a consulting and chemical engineer with headquarters in the Boston Safe Deposit & Trust Company Building, 201 Devonshire Street, Boston, Mass. Mr. Marsh was formerly connected with the Hooker Electrochemical Company and the Development & Funding Company of New York.

Cutler-Hammer Company to Increase Prices.—Beginning March 1, 1916, the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., will increase the prices of its controllers approximately 10 per cent. This increase, the company states, has been made necessary on account of market conditions and the higher price of materials.

The Driver-Harris Wire Company, Harrison, N. J., has moved its office from 565 West Washington Boulevard, Chicago, to larger quarters at 28 South Jefferson Street. S. M. Tracy, who has acted as the company's assistant sales manager for several years, with headquarters at Harrison, has been appointed Western district sales manager and will be in charge of the company's Western branch office.

The Lux Manufacturing Company, Hoboken, N. J., maker of gas-filled tungsten lamps, has appointed R. A. Berrenberg general sales manager. Mr. Berrenberg has been in the incandescent-lamp business for the past twenty years. He first became interested in the manufacture of lamps under the supervision of his father, Adolf Berrenberg, one of the pioneers of the lamp industry. He was at one time foreman in the General Electric Company's lamp works and has been affiliated with some of the largest European lamp concerns. He was formerly advertising manager of the Lux Manufacturing Company.

The General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y., manufacturer of insulating devices, reports that the year just closed has been the best year, with the exception of 1913, that the company has ever had for both net results and volume of sales. Many satisfactory orders are being received, and the company is looking forward to still better times in 1916.

Nelson P. Hall, who formerly was connected with the Electric Service Supplies Company as traveling representative in the Southwest, has opened a manufacturers' agency at 14 East Jackson Boulevard, Chicago. At present Mr. Hall is carrying the accounts of the National Brake Company, the Locke Insulator Manufacturing Company, the Coil Manufacturing & Repair Company, and a few other concerns.

The Simplex Magneto Company, 1723 Eighth Avenue, Brooklyn, N. Y., which was recently formed, is engaged in the manufacture of high-tension magnetos. L. L. Lowy, formerly with the Magneto Parts Company, is president of the company; C. Messerschmidt, formerly with the Magneto Repair Company, is vice-president, and W. J. Goldsmith, formerly with the Magneto Parts Company, is treasurer.

Big Demand for Automobile Lighting Systems.—During the week ended Jan. 15 the assembling department of the Dayton Engineering Laboratories Company, Dayton, Ohio, manufacturer of automobile lighting and starting systems, broke all former records by turning out 5789 complete sets. This is said to be the greatest week in the history of the company, the former record being 4750 "Delco" outfits, as they are called, in one week.

The American Gas & Electric Company, 30 Church Street, New York, has appointed E. Chesrown special salesman. Mr. Chesrown was formerly connected with the Westinghouse Electric & Manufacturing Company, in whose employ he had been for twenty-two years. For three years and a half he was district engineer for the Westinghouse company at Pittsburgh and for ten years in charge of sales to the steel trade in the Pittsburgh district.

Thordarson Company Opens Western Office.—The Thordarson Transformer Company of Chicago has opened an office, which will be headquarters for its Western States territory at 436 Rialto Building, San Francisco, Cal. A. S. Lindstrom, formerly assistant chief in the department of machinery at the Exposition, and who was later in charge of the 1,000,000-volt transformer demonstrations at the Palace of Machinery, is in charge of the new office.

The Bristol Company, Waterbury, Conn., has opened a new branch office at 727 Rialto Building, San Francisco, and one of its sales engineers, B. J. Klein, has been appointed Pacific district manager with headquarters at the above-mentioned office. Mr. Klein is a mechanical engineer and instrument expert, having had a long experience with the Bristol company, including a period of more than six years as Chicago district manager and of one year as manager of the company's exhibit at the Panama Exposition.

Expanded Steel Poles Prove Popular in Southwest.—The Bates Expanded Steel Truss Company of Chicago has recently closed contracts for its one-piece steel poles with the Midland Water, Light & Ice Company of Dodge City, Kan., and the Public Service Company of Oklahoma City. The Midland company has purchased 500 30-ft. poles upon which it will construct a 23,000-volt transmission line. The line will be 27 miles long and will carry three No. 6 iron wires. The poles will be spaced on 300-ft. centers. The Public Service Company has purchased 150 poles with which to build a 10-mile line.

Lack of Mangesite Hinders the Building of Electric Furnaces.—On account of the difficulty in obtaining mangesite, a mineral which is used in making brick for lining electrical furnaces, it is feared that there will be delays in the delivery of new furnaces unless a satisfactory substitute can be obtained. Mangesite is a magnesium-bearing clay which is usually obtained from Hungary. There are some deposits in the West, particularly in California, which are now being developed. The price of the mineral has advanced 300 per cent since the war began. Mangesite has a basic reaction and is essential in the process to get rid of sulphur and phosphor.

Wagner Company to Build New Plant.—The Wagner Electric Manufacturing Company of St. Louis, Mo., is reported to be contemplating the construction of an addition to its plant which will entail a cost of $55,000. W. A. Layman, president of the company, states that the building will be started within a month. The addition will increase the area of the plant 65,000 sq. ft., and it will be two stories high at one end and five stories at the other. The two-story section will be 90 ft. by 125 ft., and the five-story section 90 ft. by 100 ft. The Wagner Electric Manufacturing Company has in its employ 2000 persons and is said to be the third largest company in the United States in its line of products.

Demand for Electrical Machinery in Mexico Increasing.—Considerable electrical machinery and equipment, it is reported, is being shipped into Mexico from the United States. Practically all of the public-service electric light and power plants are badly in need of new machinery, it is declared, and orders for equipment are being placed exclusively in the United States. Much of this business used to go to Germany. Furthermore, the electrical equipment of many of the mines and industrial plants must be renewed, and this class of business will be large for some time to come. Transportation facilities in Mexico are improving rapidly, and before long regular traffic will have been established upon all of the divisions of the National Railways of Mexico and other roads.

Allis-Chalmers Company Notes Increased Earnings.—It is reported that the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has noted a net profit of $559,446 for the quarter ended Dec. 31, 1915, which is considerably larger than that for the quarter ended in September, which was $333,008, and that for the quarter ended in June, which was $194,813. In the quarters ended March 31, 1915, and Dec. 31, 1914, there were deficits of $8,910 and $46,903 respectively. Preferred dividend requirements amount to $245,000, leaving $311,946 from the net profit for the quarter ended Dec. 31, 1915, available for common dividends, or at the rate of about 5 per cent. Sales billed for the quarter amount to $3,770,149, as compared with $3,062,371 and $2,816,181 respectively for the two previous quarters. Unfilled orders on hand Dec. 31, 1915, totaled $11,056,584.

Manufacturer Plans to Secure Data on Range Operation.—The Globe Stove & Range Company of Kokomo, Ind., has put a plan into effect for collecting data on a large number of its ranges in service. When a shipment of ranges is made from the factory the company obtains, whenever possible, the names and addresses of the ultimate purchasers of the equipment. An effort is then made to learn the cost of installation from the lighting company supplying energy for the stove. Then a duplicate service sheet is mailed to the individual and a suggestion is made that he keep the record for his own information. This printed form, it is thought, will appeal to the customer when he recognizes in it a method by which he can keep an accurate account of his electric cooking expenditures. It is planned that the meter readings shall be obtained monthly from the lighting companies and that the columns on the sheet headed "Number of meals prepared" and "Number of persons" will be filled by figures obtained from the range users. At present these service records are being kept on a large number of stoves operating under widely different conditions.

Exide Batteries for Electric Vehicles.—The Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia, Pa., announces that the following is a list of manufacturers of electric-pleasure and commercial vehicles using its "Exide" batteries: The American Electric Car Company, Saginaw, Mich; the Andover Motor Vehicle Company, Andover, Mass.; the Atlantic Electric Vehicle Company, New York; the Baker R. & L. Company, Cleveland, Ohio; the Commercial Truck Company, Philadelphia, Pa.; the Empire Electric Vehicle Company, Owego, N. Y.; the General Motors Truck Company, Pontiac, Mich.; the General Vehicle Company, Long Island City, N. Y.; the Kentucky Wagon Manufacturing Company, Louisville, Ky.; the Ohio Electric Car Company, Toledo, Ohio; the Walker Vehicle Company, Chicago, Ill.; the Waverley Company, Indianapolis, Ind., and the Woods Motor Vehicle Company, Chicago, Ill. Following is also a list of prominent manufacturers of battery industrial

trucks using the "Exide" batteries: The Atlas Car & Manufacturing Company, Cleveland, Ohio; the Bettendorf Company, Bettendorf, Iowa; the Buda Company, Harvey, Ill.; the Cowan Truck Company, Holyoke, Mass.; the Galion Dynamic Motor Truck Company, Galion, Ohio; the General Vehicle Company, Long Island City; the C. W. Hunt Company, West New Brighton, N. Y.; the Jeffrey Manufacturing Company, Columbus, Ohio; the Mercury Manufacturing Company, Chicago, Ill., and the Orenstein-Arthur Koppel Company, Koppel, Pa. The company also states that its batteries are being used in over 300,000 gasoline automobiles for starting, lighting and ignition.

Increasing Use of Electric Trucks in England.—Because of war enlistments there is a scarcity of labor in many English industries, and women are therefore often taking places formerly filled by men. This is particularly the case in truck driving, and as a result instead of the heavy trucks the lighter units, which are easier to operate, are being employed. Also, on account of the simpler mechanism and ease of control electric trucks are becoming popular. While women are proving themselves efficient and careful drivers, the constant changing of gears and the necessity of cranking by physical force make the operation of heavy gasoline trucks a severe tax on their strength. The electric vehicle is therefore being utilized to a large extent for duties formerly filled by the gasoline car. In a recent letter addressed to the Electric Vehicle Association of America, the English engineering firm of Heenan & Froude, Ltd., states that the number of electric vehicles in use and on order in England is steadily increasing. The letter in part reads as follows: "The number of electric trucks is now 660, as compared with 150 a year ago. This does not appear very many at first sight. Under the circumstances, however, it is distinctly encouraging." The firm of Harrods, Ltd., which operates a large department store in London, has recently received a shipment of eighteen 0.5-ton electric delivery wagons, making a total of seventy-three electric vehicles now operated by this company. Other large installations are being made, and in many cases where gasoline cars were commandeered during the early weeks of the war they have been entirely replaced by electric-vehicle equipment. While the export of gasoline cars from this country greatly exceeds that of the electric vehicles, it is a significant fact that the majority of gasoline cars are sent to the war zone, where they have an average life of only a few months, while the electric equipment, being used only for commercial purposes, becomes a permanent installation.

New Russian Chamber of Commerce Formed.—For the purpose of upbuilding trade in Russia a new organization called the Russian Chamber of Commerce was recently incorporated at Albany by interests having important business dealings with that country. Charles H. Boynton of C. H. Boynton & Company is president of the new organization, and Thomas B. Adams is treasurer. The election of a vice-president and secretary will take place later. The provisional board of directors, which will be added to, consists of Samuel McRoberts, first vice-president of the National City Bank; Darwin P. Kingsley, president of the New York Life Insurance Company; Charles H. Sabin, president of the Guaranty Trust Company; A. B. Hepburn, chairman of the Chase National Bank; Frederick W. Allen of Lee, Higginson & Company; George McFadden of Philadelphia; William J. Chalmers of the Chalmers-Frazer Company of Chicago; Charles S. Sargent, Jr., of Kidder, Peabody & Company; Daniel G. Wing, president of the First National Bank of Boston; Hayden B. Harris of Harris, Forbes & Company; Charles Hayden of Hayden, Stone & Company, and C. H. Boynton. The association has no capitalization and will be supported only by dues and contributions. It will employ a paid secretary, whose offices will be at 60 Broadway. It is stated that the local chamber will be in effect a part of the Russian-American Chamber of Commerce of Moscow. C. J. Medzikhovsky, commercial attaché of the Russian Embassy in Washington, it is reported, was largely instrumental in getting the New York organization under way. Among the members of the association will be the American International Corporation, the International Harvester Corporation, the Westinghouse Electric & Manufacturing Company, the American Woolen Company, the United States Steel Corporation, the Midvale Steel Company, the National City Company, and other concerns. One of the first problems to be taken up, it is stated, will be the negotiation of a commercial treaty between the United States and Russia.

Consolidation of Wire Interests Effected for Management Purposes.—The Habirshaw Electric Cable Company was incorporated under the laws of the State of New York on Jan. 26 with a capitalization of $1,000,000, $600,000 of which is in common stock and the balance in preferred stock. The new company will own the Habirshaw Wire Company of Yonkers, N. Y., which will go out of existence, and also the wire and cable department of the Waterbury Company of Brooklyn, N. Y., and will in turn be controlled by the Electric Wire & Cable Company, a Connecticut corporation. Besides having a strong banking connection, it will be backed by practically the same interests which controlled the acquired properties. The Habirshaw Wire Company was owned by the J. P. Morgan interests, and the Waterbury Company by Harry Payne Whitney. The Electric Wire & Cable Company is capitalized at $1,000,000. No change will be made in its organization as a consequence of this new development. It took charge of the management of the properties on Tuesday. By this consolidation of wire interests whose annual output has a value of between $4,000,000 and $5,000 000 the Electric Wire & Cable Company will be in a position to take care of orders for every form of insulated wire and cable. No one of the three companies affected manufactures all kinds of insulated wire and cable, and for that reason it was necessary in the past in many cases of large orders to split the order and take contracts for only such material as could be manufactured in the separate plant. This, it was thought, resulted in a considerable confusion to large buyers and in a loss of a certain amount of business which it is now possible to obtain under the consolidation. A feature, however, to which more significance is attached is the management control of the properties by the Electric Wire & Cable Company. All of the manufacturing plants and commercial activities of the companies affected will now be under a central management which it is expected will effect greater economy and efficiency. Expenses will be reduced and larger earnings will result. It will be possible so to place the orders for manufacture that better deliveries will result and delays become less frequent owing to possible accidents or to large volumes of buying. Furthermore, larger economies can be effected by a central management organization, especially from the purchasing end. The officers of the new company, the Habirshaw Electric Cable Company, are as follows: President, Edwin W. Moore of the Electric Cable Company; vice-president, H. S. Satterlee of the Habirshaw Wire Company; vice-president and treasurer, J. N. Shreve of the Electric Cable Company; secretary, G. F. Waterbury of the Waterbury Company; directors: H. S. Satterlee, Cortland Betts, J. Nelson Shreve, Thomas D. Perkins, G. F. Waterbury and Edwin W. Moore.

NEW YORK METAL MARKET PRICES

	Jan. 25 Selling Prices Bid	Asked	Feb. 1 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot	91 5 0		94 10 0	
Prime Lake	25.00	to 25.50†	25.25	to 25.75†
Electrolytic	25.00	to 25.50†	25.25	to 25.75†
Casting	24.00	to 24.25†	24.12½	to 24.37½
Copper wire base	26.00	to 26.50†	26.75	to 27.25†
Lead	6.10		6.10	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	23.00†		24.00†	
Spelter	19.17½	to 19.42½	18.67½	to 18.92½
Tin, Straits	42.12½		41.80	
Aluminum, 98 to 99 per cent.	51.00	to 53.00	53.00	to 55.00

OLD METALS

Heavy copper and wire	19.50	to 20.00†	19.50	to 20.00†
Brass, heavy	13.00	to 13.50†	13.00	to 13.50†
Brass, light	10.50	to 11.00†	10.50	to 11.00†
Lead, heavy	5.00	to 5.25†	5.00	to 5.25†
Zinc, scrap	12.50	to 13.00†	15.00	to 15.25†

COPPER EXPORTS

Total tons to Feb. 1 21,863

†Nominal.

Corporate and Financial

American Telephone & Telegraph Company, New York, N. Y.—Figures for the year 1915 have not yet been made up, but, taking the figures for eleven months and estimating December, it is probable that the gross earnings of the Bell telephone system for the year were about $240,000,000, as compared with $225,952,123 for 1914. Because of better operating methods and greater efficiency and in spite of general improvement in wages, the expenses have been kept within such limits that the balance for surplus after paying interest and dividends was substantially larger than in 1913 or 1914. Plant additions for the year were about $31,500,000, which is less than in any recent year. The increase in gross earnings for the year is below the normal increase of recent years, although there has been an abnormal increase in the long-distance toll business in certain sections which taxed the company's facilities to the utmost limits. During the past year no new financing has been necessary. In 1916 the company expects to resume construction on about the same scale as experience had shown was advisable before the outbreak of the European war. This will necessitate a normal amount of new capital, or about $25,000,000, for the associated companies. Arrangements for this financing and for refinancing all indebtedness maturing in 1916 have been practically completed. The amount of capital stock outstanding on Dec. 31, 1915, was $380,477,100, an increase during the year of $35,795,200, all of which was issued in exchange for convertible bonds retired and canceled. There were outstanding on Dec. 31, 1915, $28,063,700 of 4.5 per cent convertible bonds, a decrease of $38,936,300 since conversion began.

Central Maine Power Company, Augusta, Me.—A block of $200,000 of first mortgage 5 per cent bonds, due Nov. 1, 1939, is being offered at 96.5 and accrued interest to yield 5.25 per cent.

Cities Service Companies, New York, N. Y.—Gross earnings for the calendar year 1915 showed an increase over the previous year of more than $600,000. Expenses increased by about $56,000, note interest by $70,000, while dividends on the preferred stock decreased by approximately $66,000. There were no dividends to common stock, so that the net surplus and reserve was larger than that of the previous year by almost $1,000,000. The total surplus and reserves at the end of 1915 amounted to $4,656,247. The company is now earning over 15 per cent on the outstanding common stock. The gross earnings of all subsidiary properties for the twelve months ended Nov. 30, 1915, were $22,082,178. The earnings statement of the Cities Service Companies for the year ended Dec. 31, 1915, follows:

	1915	1914
Gross earnings	$4,479,800	$3,934,453
Expenses	172,856	116,908
Net earnings	$4,306,944	$3,817,545
Interest on notes	490,000	420,000
Net to stock	$3,816,944	$3,397,545
Dividends preferred stock paid or accrued	1,570,005	1,635,993
Net to common	$2,246,939	$1,761,552
Dividends to common stock	.....	471,048
Net to surplus and reserve	$2,246,939	$1,290,504
Contingent fund	$296,344	
Surplus reserve	539,782	
Surplus	3,820,121	
Total surplus and reserve	$4,656,247	

Commonwealth Edison Company, Chicago, Ill.—At the annual meeting on Feb. 28 stockholders will vote on a proposition to increase the authorized stock from $50,000,000 to $60,000,000, as recommended by the board of directors. It is understood that $4,500,000 of the new stock will be sold during the current year, and if the company follows its previous practice, the issue will be offered to stockholders for subscription at par. The company now has outstanding $45,838,936 of stock, and the new issue will be in the ratio of one share of new stock to ten shares of old. The proceeds of the sale will be used for normal purposes.

Consumers' Power Company, Jackson, Mich.—Employees have been offered an opportunity to become holders of common stock at the reduced price of $60 a share, to be paid for at the rate of $1 per month. The amount of stock that may be purchased is governed by the employee's salary.

Louisville (Ky.) Gas & Electric Company.—A new allotment of the $750,000 issue of the three-and-one-half-year 6 per cent gold notes of the company, due April 1, 1918, are being offered at a price to yield investors 5.75 per cent. The proceeds from the sale of notes will provide for extensions to generating and distributing equipment made necessary by the growth of Louisville and the increasing demand for gas and electric service for commercial, industrial and domestic purposes.

Middletown (Ohio) Gas & Electric Company.—The company has increased its capital stock from $350,000 to $700,000.

Middle West Utilities Company, Chicago, Ill.—Through the sale of bonds to a Chicago banking syndicate the company has provided funds for the retirement of its three-year 6 per cent collateral notes, of which the original issue was $3,500,000, at maturity June 1 next. The new issue consists of ten-year collateral-trust 6 per cent bonds, due Jan. 1, 1925. Out of its current cash resources during the year the company has purchased and retired $800,000 of the notes, due June 1, leaving $2,700,000 outstanding.

Pacific Light & Power Company, Los Angeles, Cal.—Amended articles of incorporation of the company have been filed with the clerk of Fresno County. By the change the capital stock, which is $40,000,000, divided into 400,000 shares of the par value of $100 each, will consist of 144,405 shares of 7 per cent cumulative prior preferred stock, 50,000 shares of 6 per cent cumulative first preferred, 100,000 shares of second preferred, and 105,595 common shares.

Provincetown (Mass.) Light & Power Company.—The Massachusetts Gas and Electric Light Commission has just approved the issue by the company of 600 shares of stock at $100, to purchase the property of its predecessor, the Provincetown Light & Power Associates.

South Dakota Light & Power Company, Armour, S. D.—For financial and other reasons the South Dakota plants and business of the Interstate Power Company have been reorganized as a separate and distinct organization, to be known as the South Dakota Light & Power Company, which has been incorporated under the laws of the State of South Dakota. The officers of the company are: President, W. H. Burtis, Decorah, Iowa; vice-president and manager, J. F. Cameron, Armour, S. D., and secretary and treasurer, R. T. Stewart, Chicago, Ill.

Springfield (Ohio) Light, Heat & Power Company.—The Public Utilities Commission of Ohio has authorized the company to issue $181,000 of its twenty-year 5 per cent general and refunding mortgage bonds and $100,000 of its 6 per cent preferred stock, both to be sold for not less than 80. The proceeds from the sale of $150,000 worth of bonds and all of the capital stock are to be used for the reimbursement of the company's treasury to the sum of $220,000, which was expended from income for the construction of additions, extensions and improvements to its plant and for facilities for the first nine months of 1915. The proceeds from the remaining $31,000 of bonds are to be used for the reimbursement of the company's treasury for the amount paid from income into the sinking fund, under the provisions of its first mortgage.

Sullivan County Electric Company, Jasonville, Ind.—The company has been authorized by the Public Service Commission of Indiana to purchase from a bondholders' committee the entire property of the Indiana Transmission Company in the town of Jasonville for $58,200 and to assume all bills and accounts payable, which amount to approximately $5,000. The commission also has authorized the Sullivan County Electric Company to issue $24,000 of common stock and $49,000 of bonds, the proceeds to be used principally in the purchase of the Jasonville properties.

Trumbull-Vanderpole Electric Manufacturing Company, Bantam, Conn.—The company recently filed a certificate with the Secretary of State of Connecticut showing an increase in its capital stock amounting to $22,200, making the total stock $92,000. The number of additional shares authorized was 222.

United Electric Securities Company, Boston, Mass.—An issue of $500,000 of collateral trust 5 per cent gold bonds due Aug. 1, 1944, is being offered at 99 and interest to yield 5.07 per cent.

New Utility and Industrial Companies

The Thornton Light & Power Company of Thornton, Iowa, has been incorporated with a capital stock of $10,000 by H. O. Chase and others.

The Smitherman Power Company of Troy, N. C., has been incorporated with a capital stock of $300,000 to supply electricity for lamps and heaters and motors.

The Tiskilwa Electric Light Company of Spring Valley, Ill., has been chartered with a capital stock of $10,000 by C. H. Brown, Constant Brown and others.

The Rock Run Light, Heat & Power Company of Burnside, Pa., has been granted a charter with a capital stock of $5,000. W. O. Hoover of Clearfield, Pa., is treasurer.

The Spirit Lake Company of Portland, Me., has been incorporated with a capital stock of $30,000 for the purpose of constructing and operating electric-lighting and power plants.

The Ponca Light & Power Company of Sioux City, Iowa, has been chartered with a capital stock of $50,000. The officers are E. L. Snyder, president, and W. J. McFadden, secretary.

The Southwestern Public Service Company of Ardmore, Okla., has been incorporated with a capital stock of $50,000 by J. L. Hamon of Ardmore, W. F. Kerr of Oklahoma City, and F. L. Hamon of Weatherford, Tex.

The A. B. Wilson Company of Cleveland, Ohio, has been incorporated by A. B. Wilson, N. J. Wilson, M. C. Haugh, C. D. Simmons and C. B. Bayly. The company is capitalized at $10,000 and intends to deal in electrical goods, supplies, etc.

The Commercial Power Company of Jersey City, N. J., has been incorporated with a capital stock of $250,000 to generate and distribute electricity. The incorporators are L. H. Gunther, C. H. Jarvis and H. O. Black of Jersey City, N. J.

The Progressive Electric Light Company of Franklin Springs, N. Y., has been incorporated with a capital stock of $6,000 by J. W. Dawes, C. B. Vanslyke and J. B. Coleman of Franklin Springs, to supply electricity for lamps, heaters and motors.

The Bridgeport Electric Manufacturing Company of Bridgeport, Conn., has been incorporated by Robert Weber, Jr., Charles S. Ferrett and Willy E. Heldt, all of Bridgeport, Conn. The company is capitalized at $100,000 and will manufacture electrical goods, etc.

The Electric King Sales Department of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $5,000 for the purpose of manufacturing and dealing in sewing machines and electrical devices. The incorporators are C. G. Babcock, J. Markel and W. Grant King, 101 Chapin Parkway, Buffalo, N. Y.

The Washington Lighting Company of Washington, N. C., has been incorporated by Clausen Bachman, Philadelphia, Pa.; J. T. Bland and Stephen C. Bragaw of Washington, N. C. The company is capitalized at $10,000 and intends to construct and operate electric and gas plants and also to do a general contracting business.

The General Brass & Supply Company of New York, N. Y., has been incorporated with a capital stock of $10,000 to manufacture and deal in electrical machinery and devices and to do a general engineering contracting business. The incorporators are David Eisenstat, Mitchell Lubow and Isidor P. Heller, 866 Manida Street, the Bronx, New York, N. Y.

The Wilson Electric Devices Company of New York, N. Y., has been incorporated with a capital stock of $10,000 to manufacture and deal in instruments and machinery and to do a general electrical and mechanical engineering business. The incorporators are M. C. Dobson, A. M. Lovibond and D. H. Wilson, 230 West 114th Street, New York, N. Y.

The Sarco Company of Esopus, N. Y., has been chartered with a capital stock of $150,000 to manufacture machinery, steam traps, temperature regulators, engineering, railway and electrical supplies. The incorporators are M. D. Isrel, 201 West 107th Street, New York, N. Y.; H. Huber, 1390 East Fifteenth Street, and G. E. Kimmerle, 1034 Forest Avenue, Brooklyn, N. Y.

Trade Publications

Starters.—The Sundh Electric Company, New York, has recently issued leaflets on its motor starters and magnet-operated switches.

Exhaust Fan.—Exhaust and duplex cone fans are the subject of an illustrated catalog, No. 180, published by Howard & Morse, 45 Fulton Street, New York.

Reflectors.—The A-A Electric Manufacturing Company, Bridgeport, Conn., has issued Bulletin H, which contains information on the company's steel reflectors.

Electrically Operated Fans.—The Fidelity Electric Company, Lancaster, Pa., has prepared an illustrated leaflet which describes and illustrates its electric fans.

Insulation-Testing Sets.—James G. Biddle, 1211 Arch Street, Philadelphia, Pa., has issued an illustrated pamphlet entitled "A Stitch in Time" on "megger" insulation-testing sets.

Steel Conduit.—The National Metal Molding Company, Pittsburgh, Pa., has recently prepared an illustrated pamphlet on its "Sherarduct" sherardized rigid-steel conduit.

Lamp Guards.—A large-sized folder illustrated in colors has been issued by Harvey Hubbell, Inc., Bridgeport, Conn., which is descriptive of various types of incandescent-lamp guards.

Electric Appliances.—Catalog No. 64, prepared by the Lindstrom, Smith Company, 1100 South Wabash Avenue, Chicago, Ill., describes its "White Cross" electric vibrators and other electric specialties.

Telephone Holders and Accessories.—The K & B Company, 25 North Seventh Street, Philadelphia, Pa., has recently published a revised edition of a catalog on its telephone holders and accessories.

Small Electric-Lighting Plants.—Descriptive Leaflet No. 3795, published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., contains illustrations of and information on its small generating plants.

Dry Storage Battery.—J. P. Mentzer & Company, Chicago, has issued a pamphlet which is a fac-simile of its dry storage battery. The booklet contains data on operating characteristics, construction and uses of the battery.

Electric Ranges.—The Globe Stove & Range Company of Kokomo, Ind., has issued a pamphlet, of such size that it may be used as an envelope stuffer, which gives directions for using and tells the cost of operating Globe electric ranges.

Single-Phase Motors.—The Century Electric Company, St. Louis, Mo., has prepared Bulletin No. 21, which contains a large amount of information and numerous illustrations of applications of its single-phase self-starting motors of the repulsion-induction type.

Electrically Operated Fans.—The Robbins & Myers Company, Springfield, Ohio, has prepared Catalog No. 1081, which is illustrated and printed in colors, on its desk, oscillating, ceiling and exhaust fans and its hat-cleaning motors, for alternating-current and direct-current operation.

Centrifugal Pumps.—Bulletin 108-A, prepared by the Wheeler Condenser & Engineering Company, Carteret, N. J., contains information on and illustrations of a large number of types of centrifugal pumps for condenser, irrigation, drainage, dry-dock and general mill and power-plant service.

Municipal Installations of Diesel Engines.—The Busch-Sulzer Brothers-Diesel Engine Company, St. Louis, Mo., has recently issued several attractively illustrated bulletins which contain information on Diesel-engine sets employed by the city of Esterville, Iowa, the city of Menasha, Wis., and the Northwest Light & Power Company, Hutchinson, Minn.

Ornamental Lighting Standards.—The Electric Railway Equipment Company, Cincinnati, Ohio, has prepared Catalog E, which describes and illustrates its lamp standards for supporting high-efficiency tungsten lamps, Catalog D (fourth edition) on one-light, three-light and five-light ornamental lamp standards, and Catalog No. 16 on tubular-steel poles and pole fittings.

New England

LITTLETON, N. H.—The Water and Light Commissioners are considering the installation of new equipment in the municipal electric-light plant. It is proposed to change the present 133-cycle system to 60 cycles.

RUTLAND, VT.—A large electric power deal which involves upward of $1,000,000 and which includes taking over the Port Henry (N. Y.) Lt., Ht. & Pwr. Co., the installation of wires and lighting over 7 miles of territory in Crown Point, N. Y., and adjoining towns, together with the construction of a 2000-hp. power plant and a wooden-stave and steel pipe line 5200 ft. in length, thus increasing the static head of the company's power source from 100 ft. to 400 ft., has peen completed by the purchase of the stock in the company owned by Wallace Murray of Saranac Lake, N. Y., and F. Monroe Dyer & Co., New York, N. Y., who own the Hortonia Pwr. Co., Rutland. In addition to the rights owned by the Port Henry company, the new interests have acquired additional rights. Contracts have already been placed with the National Pipe & Tank Co., Portland, Ore.; the Lupins Steel Co., Boston, Mass., the S. Morgan-Smith Co., York, Pa., and the Boston office of the General Electric Co. for the hydroelectric equipment for the power house to be built by Fred H. Remington, Rutland.

ST. ALBANS, VT.—The Public Service Commission has granted the Vermont Pwr. & Mfg. Co., St. Albans, permission to sell its property and holdings to the Public El. Lt. Co. of Boston, Mass. It has also granted a certificate to the Pub. El. Lt. Co. to do business in the same towns where the Vermont company has been operating.

BOSTON, MASS.—Bids will be received by the Schoolhouse Commissioners of the city of Boston until Feb. 8 for furnishing and installing elevator and elevator machine in the Boston Industrial School for Boys, Parker and Halleck Streets, Roxbury, Boston, Mass. Copy of proposal may be obtained at the office of the commissioners, Room 1009, City Hall Annex, Boston.

BRIDGEPORT, CONN.—The Board of Apportionment has been asked again this year to provide funds for extensions to the ornamental street-lighting system.

CROMWELL, CONN.—The Connecticut River Pwr. Co., New London, is planning to extend its transmission lines from Berlin to the Connecticut River front in Cromwell, thence to Middletown. The company also contemplates the erection of a steam plant in Cromwell, to be used as an auxiliary.

NEW LONDON, CONN.—The city has awarded the Connecticut Pwr. Co. a contract for lighting the city for a period of five years. Under the terms of the new contract the flaming lamps now in use will be replaced with inclosed-arc lamps.

Middle Atlantic

BALDWIN, N. Y.—Bids will be received by F. D. Smith, secretary, at the office of the board of education, Baldwin, L. I., until Feb. 15 for construction of Baldwin Public School No. 3. Separate bids to be submitted for heating, plumbing, electrical work and general construction. Copies of plans and specifications may be obtained at the office of Tooker & Marsh, architects, 101 Park Avenue, New York, N. Y., upon deposit of $25.

DUNDEE, N. Y.—E. L. Bailey, owner of the local electric-light plant, has been granted a franchise to extend the transmission lines throughout the town of Starkey, which will reach Seneca Lake, covering a territory of 1500 additional population.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Municipal Building, New York, until Feb. 15 for furnishing electrical fittings and supplies. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Feb. 14, for installing electric equipment in new Public School 93, on Forest Avenue, between Woodbine and Madison Streets, Ridgewood Heights, borough of Queens. Blank forms, plans and specifications may be obtained or seen at the above office and at branch office, 69 Broadway, Flushing.

NEW YORK, N. Y.—Bids will be received by the Board of Health of the Department of Health, corner of Centre and Walker Streets, New York, until Feb. 15 for furnishing material required for the equipment of the various power plants in operation at the various hospitals of the Department of Health with blowers, engines, air ducts, grate bars and certain supplies and work to repair brickwork in boiler furnaces. Plans may be seen and blank forms for the above work may be obtained at the office of the chief clerk of the Department of Health.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NIAGARA FALLS, N. Y.—Negotiations have practically been closed between the Niagara, Lockport & Ontario Pwr. Co., Buffalo, and the Union Carbide Co., Niagara Falls, whereby the former will furnish the latter 20,000 hp. to operate its plant here. The new chemical plant to be erected east of the Alloys Co. plant at the north end will take 10,000 hp., and 10,000 hp. will be distributed among a number of smaller manufacturing plants. The company expects to have its transmission line to Niagara Falls completed and in operation in about two months.

NYACK, N. Y.—The capital stock of the Rockland Lt. & Pwr. Co., Nyack, has been increased from $800,000 to $1,000,000.

OLEAN, N. Y.—The Olean El. Lt. & Pwr. Co. has applied to the Public Service Commission for permission to issue and sell $126,000 in bonds and $33,300 in capital stock.

PATCHOGUE, N. Y.—The Board of Village Trustees has awarded the Patchogue El. Lt. Co. the contract for street-lighting for a period of five years and a 50-year franchise. Under the terms of the new contract the company will install a new street-lighting system. In the business section ornamental standards will be used. R. R. Hawkins is manager and treasurer of the company.

WATERVLIET, N. Y.—Plans are being considered for improvements to the municipal electric-light plant, for which $20,000 has been appropriated.

BARNESBORO, PA.—The North Cambria St. Ry. Co., Johnstown, is considering extending its street railway from Barnesboro to Hastings, a distance of about 4 miles.

HAUTO, PA.—The Lehigh Navigation El. Co., Hauto, has applied for charters in Ruscombmanor, Rockland, Muhlenberg and Upper Alsace Townships in Berks County.

MILTON, PA.—The Northumberland Gas & El. Co., Sunbury, has purchased a site in Milton on which it proposes to erect a power plant, to be equipped with two 500-hp. boilers and steam turbine. Provision will be made for the installation of additional units as required.

MOUNT GRETNA, PA.—The property of the Mount Gretna Lt. & Pwr. Co. has been purchased by the Weimer El. Co. of Lebanon. The Weimer company, which will merge the seven companies supplying electrical service in the territory adjacent to Mount Gretna with the Mount Gretna Co., will secure energy from the Edison El. Illg. Co. of Lebanon.

PHILADELPHIA, PA.—The contract for electrical work in the new City Club, 313 South Broad Street, has been awarded to the United Electrical Construction Co., Philadelphia, and that for elevators to the Otis Elevator Co.

PHILADELPHIA, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 1, for a new engine and generator in the United States post office and court house at Philadelphia, Pa. For details see proposal columns.

PHILADELPHIA, PA.—Contracts have been awarded for equipment at the St. Mary's Hospital at Frankford Avenue and Palmer Street, as follows: For lighting fixtures to the H. W. Johns-Manville Co.; for electric dumbwaiters to the Otis Elevator Co., and for refrigerating machinery to H. Dantelsorg, Philadelphia, Pa.

PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 17 for extension of power house in connection with the experiment station, Bureau of Mines, Pittsburgh, Pa. Drawings and specifications may be obtained from the superintendent of construction, 4902 Forbes Street, Pittsburgh, Pa., or at the above office.

HAMMONTON, N. J.—The Hammonton El. Lt. Co. is installing a directly connected generating unit, consisting of one 300-hp. Ames single-valve engine and a 275-kva. Westinghouse generator. Herbert C. Doughty is superintendent.

JERSEY CITY, N. J.—The City Commission is negotiating with the Hudson City Board of Trade for the installation of a new street-lighting system along Central Avenue.

SALEM, N. J.—The Board of Public Utilities has granted the Salem & Pennsgrove Trac. Co. permission to issue $656,000 in bonds and $187,000 in capital stock, the entire proceeds to be used for the construction of a new line from Salem to Pennsgrove.

BALTIMORE, MD.—The Baltimore Copper Smelting & Rolling Co., Fourth Avenue and Fifth Street, is planning additions to its plant and proposes to erect buildings on land recently purchased from the Canton Iron & Steel Co. and to place tanks for electrolytic treatment of copper to the extent of 4000 to 5000 tons per month. Contracts for buildings and machinery have been let.

CAMBRIDGE, MD.—The Eastern Shore Gas & El. Co., which controls the Cambridge Gas & El. Co., is erecting an electric transmission line from Sharptown to Cambridge.

CUMBERLAND, MD.—The proposal to issue $25,000 in bonds for improvements to the municipal electric-light plant will be submitted to the voters.

COWEN, W. VA.—Application has been made to the Council by Walter Mills and J. S. Mills for a franchise to install an electric-light plant and to lay water mains in Cowen.

SISTERSVILLE, W. VA.—A site has been secured in Sistersville by the Caldwell Chemical Co., Evansville, Ind., on which it will erect a plant for the manufacture of chemicals, at a cost of about $100,000. Considerable electric equipment, it is understood, will be required.

BIG STONE GAP, VA.—The El. Transmission Co. of Virginia, recently organized as a subsidiary of the Middle West Utilities, Chicago, Ill., has taken over the El. Transmission Co., the Powell Valley Lt. & Pwr. Co., Big Stone Gap, and the Pennington Lt. Co. The new company owns a generating station of 3500-kw. rating and 22 miles of 30,000-volt transmission lines, all on private right-of-way, and about 200 acres of coal lands. It has closed contracts with several coal-mining companies to furnish electrical energy, the largest being with the Stonega Coke & Coal Co. of Big Stone Gap for a minimum of 3000 hp.

WASHINGTON, D. C.—Bids will be received at the office of the general supply committee, the Auditors' Building, Washington, D. C., until March 6, for furnishing, as they may be ordered from time to time during the fiscal year beginning July 1, 1916, and ending June 30, 1917, the following material, supplies and equipment to the various governmental departments and independent establishments in the city of Washington. Class (1) stationery and drafting supplies; (2) hardware, metals, leather and saddlery; (5) laboratory apparatus and hospital appliances and surgical instruments; (6) electrical, engineering and plumbing supplies; (12) photographic supplies, meteorological instruments, towers, etc.; (15) incandescent elec-

New Lighting System Proposed for New Orleans

On March 15, 1916, W. B. Thompson, commissioner of public utilities of the city of New Orleans, will sell at auction a ten-year franchise governing the lighting of streets and parks and the supplying of electrical energy for the public buildings. The street-lighting system which it is planned to erect under the new franchise will consist of 404 series magnetite 5.5 amp., 412.5-watt direct-current arc lamps equipped with refractors and fed from underground wires; 2683 arc lamps of the same type fed from overhead lines; 1758 single 250-cp. incandescent lamps, mounted on ornamental iron standards like the one shown in the accompanying illustration, maintained from underground circuits, and 128 five-lamp standards, also fed from underground mains. The entire lighting system must be ready for operation within 18 months from the date of the acceptance of the franchise. The single-lamp standards, as well as much of the remainder of the system, have been designed under the direction of Foster Olroyd, city electrician of New Orleans.

tric lamps (special form A); (16) incandescent gas-lamp supplies; (17) motor trucks (special form A); (18) computing machines and typewriter equipment and repair parts (special form A); (19 electric service; (20) telephone service. Bidders desiring to submit proposals should apply to the superintendent of supplies, general supply committee, the Auditors' Building, Washington.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Newport, R. I., Schedule 9235—400 air-pressure gages. Annapolis, Md., Schedule 9233—one 50-kw. generator set. Philadelphia, Pa., Schedule 9230—16 steam traps. Brooklyn, N. Y., Schedule 9238—miscellaneous steam traps; Schedule 9222—three auxiliary feed pumps, three main boiler-feed pumps, two circulating distiller pumps, two condenser air dynamo pumps; Schedule 9230—25 vertical, simplex-feed pumps; Schedule 9221—six oil service pumps. Washington, D. C., Schedule 9225—one outfit for pumping water. Pensacola, Fla., Schedule 9223—one automatic cylindrical grinder. Portsmouth, N. H., Schedule 9249—200 copper dies. Boston, Mass., Schedule 9251—miscellaneous copper wire. Mare Island, Cal., Schedule 9244—one storage battery, one motor-generator set, one switchboard, and three transformers. Brooklyn, N. Y., Schedule 9252—6500 ft. interior communication cable, miscellaneous telephone cable, 950 lb. hard sheet rubber; Schedule 9245—two direction-finding radio sets. Philadelphia, Pa., Schedule 9252—miscellaneous magnet wire. Washington, D. C., Schedule 9254—1500 lb. brass tubing; Schedule 9255—miscellaneous steel tubing; Schedule 9253—one hydraulic pump. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Commerce Reports as follows: No. 19,842—An American consular officer in Spain reports that a company in his district is in the market for steel axles, wheels and tires for trolley cars, rails, switch-points and frogs, safety signals with operating apparatus, iron and steel beams, lumber and all classes of building material. It is also stated that the firm will soon be in the market for equipment of a connecting line of about 2½ miles, consisting of four first-class cars suitable for suburban traffic, overhead-trolley system. No. 19,845—An American consular officer in one of the neutral European countries states that a firm which is building a post office in his district is in the market for 11,000 sq. m. (about 118,300 sq. ft.) of prismatic glass, extra transparent, 3 cm. (about 1 1/5 in.) thick, interior telephone system, connecting 200 rooms, 250 electric clocks, 250 electric bells, 150 desk keyboards with from four to six bells each, and pneumatic-tube system, diameter of tubing 3 in. Correspondence should be in Spanish. Weights and measures should be in the metric system. Discounts, terms and full details, accompanied by illustrations or photographs, should be furnished. No. 19,854—An American consular officer in China reports that a firm in his district is in the market for equipment and accessories for the installation of an electric-lighting plant. It is proposed to install a water-tube boiler, a surface condenser, a reciprocating 100-hp. engine of 400 r.p.m. and a 60-kw., 220-volt dynamo. About 40,000 ft. to 50,000 ft. of insulated wire of various sizes will be required. Correspondence should be in Chinese, but may be sent in English to the consulate, where translation will be made and forwarded to the firm. No. 19,872—An American consular officer in India writes that a firm in his district wishes to communicate with American manufacturers of electric bells, lamps, telephones, oil motor fans, novelties, etc. No. 19,876—A man in Spain informs an American consular officer that he desires to purchase steel cables in large quantities. Correspondence should be in Spanish. No. 19,913—A commercial agent of the bureau transmits an inquiry from a firm in Switzerland which desires to purchase electric-lamp sockets, both with and without keys. Samples, catalogs and full information should be sent. No. 19,917—A commercial organization in the United States writes that a firm in the United Kingdom desires to communicate with American manufacturers of lenses for electric pocket lamps. No. 19,926—A commercial agent of the bureau transmits an inquiry from a firm in the Netherlands which desires to receive samples, prices and full information from American manufacturers of tungsten metal-filament electric lamps, similar to that known as "Astra"; bulbs for electric lamps and accessories for same. No. 19,934—A commercial agent of the bureau transmits an inquiry from a firm in the United States which desires to communicate with American manufacturers of tools, hardware, builders' supplies, wire goods, electrical supplies and specialties, kerosene and gasoline engines, pumps, lubricating oil, etc., with a view to the introduction of such goods in China. No. 19,945—The British Trade Commissioner in New Zealand reports that tenders will be received at the office of the town clerk, Raetihi (North Island), until March 14, for supplying and erecting a 40-kw. hydroelectric generating set, switchboard, etc. Copies of specifications and drawings may be obtained from H. W. Climie & Son, Raetihi, New Zealand, upon deposit of $4.86, which will be refunded upon a bona fide tender. The bureau has no further information in regard to this opportunity. No. 19,866—An American consular officer in Spain writes that a man in his district desires to represent American manufacturers of brass tubing such as is used for certain rods and lighting fixtures. No. 19,965—A commercial agent of the bureau transmits an inquiry from a man in Colombia who desires to receive catalogs, prices and full information from American manufacturers and exporters of pumps, rams, gas engines, plumbing outfits, hot and cold water systems, burglar alarms, etc. Further information may be obtained upon application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

North Central

ISHPEMING, MICH. — The Cleveland-Cliffs Iron Co., it is reported, is contemplating the construction of a large hydroelectric plant on Dead River north of Ishpeming.

MONROE, MICH.—At an election held Jan. 24 the proposal to issue $75,000 for the installation of a municipal electric-light plant was defeated.

PETOSKEY, MICH.—At an election to be held Feb. 14 the proposal to issue $35,000 in bonds to purchase the power plant of the W. L. McManus Lumber Co. will be submitted to the voters. It is proposed to operate it in connection with the municipal electric-light plant.

AKRON, OHIO.—Preparations are being made by the Northern Ohio Trac. & Lt. Co., Akron, it is reported, to triple the output of its plant at the Gorge. The plans provide for the installation of two 20,000-kw. turbo-generators and accessories.

ALLIANCE, OHIO.—The installation of a municipal electric-light plant, to cost about $100,000, is under consideration. Joseph McConnell is director of public service.

CLEVELAND, OHIO.—Plans have been filed with the City Building Department by the Cleveland El. Illg. Co. for the erection of a substation (56 ft. by 50 ft.), to be erected at 6513 Union Street, to cost about $16,000.

COLUMBUS, OHIO.—Preparations are being made by the Columbus Ry., Pwr. & Lt. Co. for the installation of a 6500-kw., 4150-volt Curtis turbo-generator at its Columbus station. The company is also planning to erect a three-phase, 13,200-volt transmission line to South Columbus, to cost about $60,000. The line will be part overhead and part underground construction.

OLMSTED FALLS, OHIO.—Bids will be received by F. R. Gallagher, clerk of the board of education of the Olmsted Township Rural School District, until Feb. 28 for the construction of school building, including electric wiring. Plans and specifications are on file with W. H. Nicklas, Euclid Building, Cleveland.

SPRINGFIELD, OHIO.—Plans are being considered by the Robbins & Myers Co., Springfield, for the construction of a large addition to its plant, which with machinery will cost about $200,000. Considerable electrical equipment, it is understood, will be required.

STEUBENVILLE, OHIO.—An entire new street-lighting system will be installed if the lamps installed on trial prove satisfactory. The Steubenville & East Liverpool Ry. & Lt. Co. has the contract for street lighting.

YOUNGSTOWN, OHIO.—Work will begin at once on the construction of the proposed McDonald Merchant bar mills (to cost $5,000,000) on the Mahoning River between Youngstown and Niles. The cost of the plant and of railroad connecting the proposed mills with this city and the power plant is estimated at about $7,000,000. Plans also have been prepared for a by-product coke plant of more than 200 ovens and a large general office for this district.

BERRY, KY.—The Juanite Hotel Co. is contemplating the installation of an isolated electric-power plant. B. J. Gillespie is president.

KUTTAWA, KY.—The installation of an electric-lighting and power plant is reported to be under consideration by the Kuttawa Milling Co. William Eades is manager.

LOUISVILLE, KY.—Plans have been approved by the Louisville Gas & El. Co. for increasing the output of its electric generating system from 20,000 kw. to 35,000 kw. by the installation of a 15,000-kw. generating unit. The proposed addition will include extension to power station, a 250-ft. smokestack, cooling tanks, and a tunnel to the Ohio River. The cost of the proposed work is estimated at $1,000,000.

TAYLORSVILLE, KY.—New equipment is being installed in the plant of the Taylorsville Ltg. Co.

HEBRON, IND.—The Hebron Lt., Ht. & Pwr. Co. has increased its capital stock from $25,000 to $100,000.

DANVILLE, ILL.—The Danville St. Ry. & Ltg. Co. has applied for a certificate of convenience and necessity to extend its electric transmission line to territory in Vermilion County adjacent to the plant of the Hegeler Zinc Co.

DUNNING, ILL.—Bids will be received by Frank G. Whipp, fiscal supervisor, Springfield, until Feb. 15 for furnishing and installing complete power plant piping and accessories for a power house at the Chiago State Hospital, at Dunning. Martin C. Schwab, Mallers Building, Chicago, is consulting engineer.

HILLSBORO, ILL.—The Southern Illinois Lt. & Pwr. Co., Hillsboro, has applied to the State Public Utilities Commission for authority to issue $200,000 in bonds.

IVESDALE, ILL.—The village of Ivesdale has granted the Bement (Ill.) El. Lt. & Pwr. Co. a franchise to supply electricity in Ivesdale for a period of 30 years and a contract for street lighting for a term of ten years. Work will soon be started on the erection of the transmission line.

MACOMB, ILL.—Bids will be received at the office of John Grams, city clerk, Macomb, until Feb. 17 for furnishing and installing an ornamental street-lighting system, consisting of 61 five-lamp standards.

ST. CHARLES, ILL.—Bids will be received by the State Board of Administration, Capitol Building, Springfield, until Feb. 23 for construction of an employees' building at the St Charles School for Boys, St. Charles. Separate bids to be submitted on general work, heating, plumbing and electric wiring.

SPRINGFIELD, ILL.—The contract for electric wiring and fixtures for the new high school has been awarded to the F. H. Cheyne Co. of Indianapolis, at $6,380, and also that for bells, telephones and clock system, at $3,000.

STREATOR, ILL.—Bids will be received by the Board of Local Improvements, Streator, until Feb. 8 for the installation of an ornamental street-lighting system on Main and Vermilion Streets.

BUTTERNUT, WIS. — The Wisconsin Railroad Commission has granted the Butternut El. Lt. & Pwr. Co. permission to issue $5,000 in capital stock, the proceeds to be used for the construction of an electric light and power plant in Butternut.

MANITOWOC, WIS. — The Wisconsin Pub. Ser. Co., Green Bay, has acquired the property of the West Side El. Pwr. & Ht. Co., Manitowoc. The Wisconsin Pub. Ser. Co., which owns and operates a large electric-power plant at High Falls on the Peshtigo River, it is reported, contemplates the construction of another dam and power plant at Johnson Falls, near High Falls, and proposes to extend its electric transmission line through Manitowoc to Sheboygan, where it owns the gas plant.

MILWAUKEE, WIS.—Preparations are being made by the El. Steel Casting Co. to begin work on the construction of a modern steel plant to be erected on a 20-acre tract, extending from Sixty-second to Sixty-eighth Avenue on the north side of West Allis. The entire plant will be operated by electricity. Leo G. Smith is president and general manager.

OSHKOSH, WIS.—Bids will be received by the Board of Regents of the Normal Schools of Wisconsin at the office of the board in Madison until March 1 for construction, complete, of a three-story-and-basement normal school building for the State Normal School at Oshkosh. Separate bids to be submitted for plumbing and sewerage work, heating and ventilating, tile and marble work, and electrical work. Plans and specifications are on file at the office of the board of regents, Madison; at the office of Van Ryn & De Gelleke, architects, 726 Caswell Block, Milwaukee, and at the Builders & Traders' Exchanges in Oshkosh and Milwaukee. Copies of plans and specifications may be obtained at the office of the state engineer upon deposit of $10.

DANUBE, MINN.—The installation of an electric-lighting plant in Danube is under consideration.

HIBBING, MINN.—The City Council, it is reported, is contemplating extensive improvements to the municipal electric-light plant or the installation of an entirely new plant.

SOUTH ST. PAUL, MINN.—Bids will be received by the Board of Police and Fire Commissioners of South St. Paul until Feb. 12 for erecting electric wires and other work in connection with the fire and police alarm system. Plans and specifications may be obtained of J. Bears, secretary of the board.

SPRINGFIELD, MINN.—The new plant of the Ochs Brick & Tile Co. will be equipped with electrically driven machinery. The company will install an electric generating plant of about 300-hp. rating.

CEDAR RAPIDS, IOWA.—The Iowa Ry. & Lt. Co., Cedar Rapids, has been granted franchises to operate electric light and power systems in the villages of Bearing, McCallsburg and Clemons.

CHESTER, IOWA.—At an election to be held Feb. 8 the proposal to grant a franchise to D. W. Davis to install and operate an electric-light plant in Chester for a period of 20 years will be submitted to the voters.

LAWLER, IOWA.—The proposal to issue $8,000 in bonds for the installation of an electric-lighting system in Lawler will be submitted to the voters on Feb. 10.

MASON, IOWA.—Improvements, it is reported, are contemplated by the People's Gas & El. Co., Mason City, to cost about $15,000.

ORIENT, IOWA.—At an election to be held Feb. 7 the proposal to issue $10,000 for the installation of an electric-lighting plant will be submitted to the voters.

SHEFFIELD, IOWA.—The installation of a municipal electric-light plant in Sheffield is under consideration.

MEMPHIS, MO.—Preliminary surveys are being made for the installation of a municipal electric-light plant in Memphis. David G. Fischer & Co., Davenport, Iowa, are engineers.

ANAMOOSE, N. D.—The Anamoose El. Co. is contemplating installing a 200-amp.-hr. storage battery in the spring. N. J. Walper is president and manager.

ARMOUR, S. D.—For financial and other reasons the South Dakota plants and business of the Interstate Pwr. Co. have been reorganized as a separate and distinct organization, to be known as the South Dakota Lt. & Pwr. Co. The officers of the company are: W. H. Burtis, Decorah, Iowa, president; J. F. Cameron, Armour, vice-president and manager, and R. T. Stewart, Chicago, Ill., secretary and treasurer.

BROOKINGS, S. D.—The municipal electric-lighting plant is being enlarged and new equipment installed, including a 200-kw. General Electric generator, a 20-in. by 22-in. Ball engine and two 100-hp. Murray boilers, equipped with Allan stokers. The cost of the improvements is estimated at $30,000. A. W. Morton is superintendent.

AINSWORTH, NEB.—The Ainsworth Lt. & Pwr. Co. is contemplating the erection of between 20 and 25 miles of transmission lines to connect up two towns during the coming summer. W. V. Finney is manager.

FAIRBURY, NEB.—Plans are being prepared by the Lincoln (Neb.) Tel. & Teleg. Co. for extensions to its local system, including additions to its switchboard and extensions to telephone lines, to cost approximately $75,000.

GUIDE ROCK, NEB.—Bids will be received by the School Board, District No. 1, Webster County, Guide Rock, until Feb. 29 for construction of a high-school building. Bids will be received at the same time for the plumbing, heating and ventilation, and electric wiring. Plans and specifications are on file with J. H. Crary, secretary, Guide Rock, and with R. A. Bradley & Co., architects, Hastings, Neb. Copies may be obtained on application to the architects, for which a deposit of $25 is required.

OMAHA, NEB.—Work will begin at once on the construction of the Masonic Temple in Omaha, to cost about $375,000. George B. Prinz, Omaha National Bank Building, is architect.

OMAHA, NEB.—Bids are being received by Harry Lawrie, architect, Paxton Building, Omaha, for construction of the Princess Theater, including general contract, steam heating, electric wiring, sidewalk lamps, temperature regulator, fire escapes, etc. The cost of the building is estimated at $70,000.

ANTHONY, KAN.—The installation of a municipal electric-lighting system in Bluff City is under consideration. It is proposed to erect an electric-transmission line from Anthony to secure energy to operate the system.

AURORA, KAN.—The election recently held, at which the citizens voted to issue $45,000 in bonds for an electric-light plant, has been declared illegal. A new election will probably be caled.

CHERRYVALE, KAN.—The Kansas Gas & El. Co., Wichita, is contemplating improvements to its plant in Cherryvale. C. Hill is local manager.

FOWLER, KAN.—The City Council is reported to have engaged H. M. McGruder, Liberal, consulting engineer, to overhaul and improve the electric-lighting system.

NORTON, KAN.—The installation of an additional generating unit in the municipal electric-light plant is under consideration.

OLATHE, KAN.—The City Commissioners have decided to call an election to submit to the voters the proposal to issue $55,000 in bonds to install or purchase an electric-light plant. The Olathe El. Lt. & Pwr. Co. has petitioned for an extension of ten years to its franchise, which expires in two years. In return for the extension the company has offered to install, at its own expense, ornamental lamps around the square and also a new street-lighting system.

TOPEKA, KAN.—The erection of an additional lighting circuit on the West Side to make possible future suburban extensions, to cost about $1,000, has been announced by E. G. Stahl, superintendent of the municipal plant.

TOPEKA, KAN.—The report of Elmer G. Stahl, superintendent of the municipal electric-light plant, recommending that all arc lamps be replaced (when worn out) by 400-cp. tungsten lamps, has been approved by Commissioner Frank M. Newland. The installation of a turbo-generator in the municipal electric plant for auxiliary purposes is also recommended in the report.

Southern States

MORGANTON, N. C.—A water-power site on the Catawba River, 15 miles west of Morganton, has been purchased by H. L. Millner and associates. Contracts, it is understood, have been awarded for construction of dam and power house.

NASHVILLE, N. C.—At an election to be held Feb. 15 the proposal to issue $10,000 in bonds for the construction of an electric-light plant will be submitted to the voters.

CHARLESTON, S. C.—In the annual report for 1915 submitted by Pon Simons, city electrician, the installation of a new and complete police-alarm system is recommended.

HONEA PATH, S. C.—Negotiations are under way between the Southern Pwr. Co., Charlotte, N. C., and the Chiquola Mfg. Co., Honea Path, whereby the former will furnish the latter with energy (secondary power) to the amount of 1600 hp. to operate its plant. The Southern Pwr. Co. is planning to erect a 100,000-volt transmission line from Greenwood to Belton and from Anderson to tap its line from Tallulah Falls at some point on the Air Line.

ATLANTA, GA.—The Georgia Ry. & Pwr. Co., Atlanta, is contemplating extending its Atlanta-Lindale transmission line to Cedartown, to furnish electrical service in the latter town.

AUGUSTA, GA.—Swift & Co., it is reported, are planning to erect an oil mill, to cost $200,000, in Augusta, which will be operated entirely by electricity. A contract has been closed with the Georgia-Carolina Pwr. Co. to furnish the mill with 600 hp.

DALTON, GA.—Plans are being considered by the Board of Water, Light and Sinking Fund Commissioners for extensions to the municipal water, light and gas plants this year.

MILLEN, GA.—An additional 100-hp. boiler is now being installed in the municipal light and water plant and also a 6-in. suction water pump. The installation of a 50-kw. generating unit, directly connected, is contemplated. H. B. Davis is superintendent.

CAVE, TENN.—The Cave Wtr. & Pwr. Co., it is reported, contemplates further development of its hydroelectric plant. J. M. Taylor is manager.

NASHVILLE, TENN.—The Nashville Ry. & Lt. Co. is contemplating the installation of a substation between West Nashville and the West End car lines.

SEVIERVILLE, TENN.—The Sevierville Milling Co. is reported to be contemplating the installation of an electric-lighting plant.

HURTSBORO, ALA.—An election will be held Feb. 9 to submit the proposal to issue $9,000 in bonds for extensions to the light and water systems to the voters.

FORT SMITH, ARK.—Plans are being considered by T. J. Hays, city commissioner, for the establishment of a municipal electric-light plant in Fort Smith.

HARTFORD, ARK.—The City Council has engaged the Benham Engineering Co., Oklahoma City, Okla., to prepare plans for municipal electric-light plant and waterworks system.

SULPHUR ROCK, ARK.—The installation of an electric-light plant in Sulphur Rock is under consideration. Smith Brothers are reported to be interested in the project.

CHANDLER, OKLA.—If granted a new franchise, Johnson & Henderson, it is reported, will rebuild the local electric-light plant.

RUSH SPRINGS, OKLA.—The installation of an electric-lighting system in Rush Springs is under consideration.

CLEBURNE, TEX.—The Cleburne street-railway system is reported to have been purchased by F. C. Cotton of Denver, Col. Improvements, it is understood, will be made.

CORPUS CHRISTI, TEX.—The property of the People's Lt. Co., Corpus Christi, has been purchased by the Corpus Christi Ry. & Lt. Co.

EL PASO, TEX.—The contract for the installation of an electric plant for the new court house has been awarded to the Hamilton Co., Dallas, at $15,000.

GEORGETOWN, TEX.—During the latter part of the year an engine and generator will be installed in the municipal electric-light and water plant. R. E. Ward is manager.

HOUSTON, TEX.—A report has been submitted to the Mayor by Clarence George, city electrician, recommending an appropriation of $10,000 for the removal of overhead wires and extending the police and fire-alarm boxes throughout the city during the year.

McALLEN, TEX.—Contract has been awarded by the McAllen's Pub. Ser. Corpn. for the construction of its power station. The company, it is understood, will expend about $25,000 for equipment for the plant.

PHARR, TEX.—The Pharr Ice, Lt. & Pwr. Co., it is reported, will install new machinery in its plant.

SOUR LAKE, TEX.—Steps have been taken by F. H. Carpenter and others to organize a company to be known as the Sour Lake Ice & Lt. Co. to install and operate a combined electric-light and ice plant, to cost about $40,000.

TEAGUE, TEX.—The electric plant of the Telluride Pwr. Co., Teague, was recently damaged by fire, causing a loss of from $5,000 to $10,000.

VICTORIA, TEX.—The City Council has ordered a survey made to determine the feasibility of building a municipal electric-lighting plant in Victoria.

Pacific States

VALLEYFORD, WASH.—The Valleyford Wtr. Co. has applied to the commissioners of Spokane County for permission to erect and operate transmission lines in the streets of the town of Valleyford and on the county roads of the township.

LA GRANDE, ORE.—The Mill Creek power plant of the Eastern Oregon Lt. & Pwr. Co., Baker, was recently destroyed by fire.

OREGON CITY, ORE.—Investigations are being made by Mayor Hackett of the power rights of Oregon City at the falls of the Willamette, with a view of advocating the installation of a municipal electric plant. The city holds a lease of several hundred horsepower at the falls.

SALEM, ORE.—A permit has been granted by the State engineer to Horace G. Campbell, West Lake, to develop power at the outlet of Whoahink Lake in Lane County.

LOS ANGELES, CAL.—Plans have been completed by George Low, architect, 904 Hall of Records, Los Angeles, for additional buildings to be erected at the County Hospital, including tuberculosis-ward buildings, to cost $250,000; service building, $100,000, and a new power house and stack, $26,000. The cost of the equipment for the proposed buildings is estimated at $69,150.

LOS ANGELES, CAL.—Bids will be received by the Board of Public Service, Los Angeles, until Feb. 15 for street-lighting equipment as follows: Nine arc-lamp regulators and rectifiers and 650 arc lamps; with alternate proposal for four incandes-

cent lamp regulators and 650 incandescent street-lighting fixtures. Specifications are one file in the office of the secretary, 506 Knickerbocker Building, Los Angeles.

LOS ANGELES, CAL.—Specifications for the street-lighting equipment in the East Los Angeles-Garvanza-Highland Park district (to cost $375,000) and the Hollywood and East Hollywood district (to cost $350,000), where the city proposes to parallel the distributing systems of the private companies, have been approved by the Public Service Commission. Bids for equipment will be called for at once. The commission, it is understood, has authorized bids to be asked for transformers for the proposed power system. E. F. Scattergood is chief electrical engineer.

TROPICO, CAL.—An election will probably be called to submit to the voters the proposal to issue $75,000 in bonds for the construction of an electric-lighting and water-works system.

WELLSVILLE, UTAH.—The city officials are negotiating with the Utah. Lt. & Pwr. Co. for the sale of the municipal electric-lighting system. The city owns the distributing system and purchases energy from the Utah company.

HELENA, MONT.—Plans have been prepared for the installation of a new street-lighting system, consisting of 225 straight posts and globes, mounted with a 60-cp lamp, maintained by underground wires, to cost about $16,000. Contracts for installation of system will be awarded in the near future. John D. McLeod is city engineer.

Canada

MONTREAL, QUE.—Plans and specifications, it is reported, will be started soon for a hydroelectric power and pumping station at the end of the aqueduct canal for the city of Montreal. The proposed plant will have a generating capacity of 10,000 hp., the greater part of which will be used for pumping water into the city reservoir, the remainder for lighting purposes. The cost of power station, including machinery, equipment, etc., is estimated at $1,500,000. Frederick E. Field is resident engineer.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Midwinter convention, New York, Feb. 8 and 9.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark. Convention, May 9-11.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 62 Cedar St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. O. Oschman, Oliver Iron & Steel Co., Pittsburgh, Pa. Annual convention, Chicago, Sept. 18-22.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, James Redpath, 505 Rialto Building, San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, C. A. Littlefield, 130 East 15th St., New York.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. E. Kearns, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Annual meeting, Hotel Statler, Detroit, Feb. 15-17.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., New York. Sections in the principal electrical centers throughout the country.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Wier, Athens, Ga.

ILLINOIS ELECTRIC ASSOCIATION. Secretary, H. E. Chubbock, Peoria, Ill.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, C. A. Littlefield, 15th St. and Irving Place, New York. Midwinter convention, New York, Feb. 10 and 11.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 71 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thomson, Jr., Des Moines, Iowa. Annual meeting, Dubuque, Iowa, May 10-12.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Thomas A. Wynne, Indianapolis, Ind.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Temporary secretary, E. A. Wright, Manhattan, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St., New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St., N., Minneapolis, Minn.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, R. H. Smith, Jackson, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York. Annual convention, Chicago, May 22-27.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, New York, July 18-22, 1916.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M. Meeting, Albuquerque, Feb. 14-16, 1916.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, E. H. LaTourneau, 602 Electric Building, Portland, Ore.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus. Annual meeting, Cleveland, June 15 and 16.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, 435 Sixth Ave., Pittsburgh, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.,

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Chas. W. Graham, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

UNITED STATES INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, W. S. Vivian, 19 South LaSalle St., Chicago, Ill.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, Milwaukee, March 16 and 17.

Record of Electrical Patents

Notes on United States Patents issued Jan. 25, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,169,138. SAFETY SIGNAL DEVICE; B. M. Downs, Buffalo, and W. S. Cook, Lackawanna, N. Y. App. filed March 15, 1915. For automobiles and street cars.

1,169,174. ELECTRIC DRIVING APPARATUS; M. B. McLauthlin, Malden, and A. K. Tyler, Brookline, Mass. App. filed July 9, 1909. For dumbwaiters and the like.

1,169,179. MAGNETO-ARMATURE; H. C. Mueller, Milwaukee, Wis. App. filed June 1, 1915. Built in flywheel.

1,169,182. THERMIONIC TRANSLATING DEVICE; A. McL. Nicolson, New York, N. Y. App. filed April 19, 1915. Cathode element heated by radiation from adjacent heater.

1,169,187. PLUG SWITCHING DEVICE; A. S. Pearl, Maynard, and C. A. Jansen, Chicago, Ill. App. filed Dec. 26, 1912. Socket member of plug is mounted in casing.

1,169,190. SIGN RECEPTACLE; C. D. Platt, Bridgeport, Conn. App. filed Aug. 10, 1914. For application to sheet-metal sign.

1,169,194. SWITCH DEVICE FOR FIRE ALARMS; G. B. Ratterman and W. W. Garrison, Birmingham, Ala. App. filed Aug. 3, 1914. Normally inactive switch moved by heat.

1,169,211. ELECTRIC CONDUCTOR; C. J. E. Waxbom, Columbus, Ohio. App. filed Dec. 16, 1910. Trolley wire for mine locomotives.

1,169,213. ELECTRIC HEATING UNIT; H. G. Weeks, Chicago, Ill. App. filed Jan. 10, 1912. Stoves and flatirons.

1,169,215. ELECTRIC VULCANIZER; E. J. Wiggins, Chicago, Ill. App. filed July 27, 1914. Operable by a current of automobile battery.

1,169,246. INSULATOR; A. J. Folstad, Balaton, Minn. App. filed March 22, 1915. Glass insulator of hook form.

1,169,251. ELECTRIC RELAY; J. F. Gaffney, Steelton, Pa. App. filed May 24, 1915. Telephone-line relay.

1,169,258. CELL; W. Hopper, Lawndale, Cal. App. filed June 1, 1915. Dry cell with one electrode coated with glucose and a dry powder.

1,169,262. ELECTRIC HEATER; W. D. Huff, Lafayette, La. App. filed May 27, 1915. For submerging in crude oil, water, etc.

1,169,263. CASING FOR ELECTRICAL APPARATUS AND REMOVABLE LOCKING AND INSULATING MEANS; J. Keefe, Boston, Mass. App. filed April 24, 1912. Removable cap lining with shell-locking means.

1,169,273. INTERLOCKING RELAY FOR RAILWAY SIGNALS; C. E. Mason, Chicago, Ill. App. filed Sept. 13, 1907. For crossing signals.

1,169,291. TELEPHONE SYSTEM; F. M. Slough, Elyria, Ohio. App. filed Oct. 18, 1913. Automatically rings subscriber after connection is set up.

1,169,314. TERMINAL PLUG; R. E. Zannoth and V. B. Dickson, Detroit, Mich. App. filed April 12, 1915. For electric irons.

1,169,320. TELEPHONE EXCHANGE SYSTEM; W. W. Dean, Elyria, Ohio. App. filed May 20, 1907. "Clearing out" and "cutting off" effected by acts of the subscribers jointly.

1,169,338. ELECTRIC-LIGHTING DEVICE; J. A. Martin, Spokane, Wash. App. filed May 11, 1914. Mounted on automobile dashboard with extensible cord.

1,169,346. ELECTRIC CLUSTER LAMP; T. O'Donnell, Ironwood, Mich. App. filed Sept. 30, 1914. Plurality of bulbs having a common neck.

1,169,350. ELECTRICAL ACCUMULATOR; L. W. Pullen, Philadelphia, Pa. App. filed June 16, 1911. Improved construction and increased efficiency.

1,169,362. ELECTRIC STORAGE BATTERY; J. M. Skinner and V. R. Bottone, Philadelphia, Pa. App. filed April 9, 1914. Particularly for round lamps.

1,169,372. BUSHING FOR COVERED WIRES; H. J. White, San Francisco, Cal. App. filed Feb. 25, 1914. Cheap and easily applied.

1,169,382. BRIDGE FOR ELECTRICAL CONDUCTORS; L. W. Crompton and E. N. Oliver, Tampa, Fla. App. filed Dec. 18, 1914. Open cleat and molding work.

1,169,384. APPARATUS FOR SINTERING AND SMELTING ORES; A. S. Dwight, New York, N. Y. App. filed March 31, 1910. For treatment of iron, etc.

1,169,387. AUTOMATIC SWITCH FOR TELEPHONE SYSTEM; K. E. Ericsson, Salisjo-Storangen, and G. W. Dahlstrom, Stockholm, Sweden. App. filed July 16, 1913. No reaction from currents belonging to same station can take place.

1,169,390. PANEL BOX; H. J. L. Frank and L. H. Frank, Wheeling, W. Va. App. filed Feb. 20, 1912. Cover and switch construction.

1,169,391. ELECTRICAL SWITCH; H. J. L. Frank and L. H. Frank, Wheeling, W. Va. App. filed Feb. 20, 1912. Snap switch for mounting on panelboard.

1,169,394. PORTABLE ELECTRIC LAMP; H. M. Greist, New Haven, Conn. App. filed May 13, 1915. Has suction cup in base.

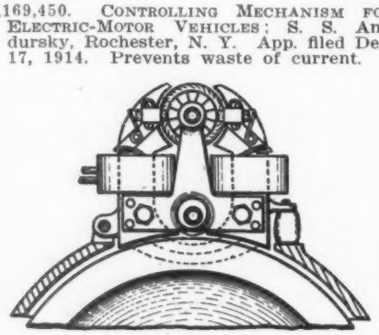
1,169,422. THERMIONIC REPEATER; A. McL. Nicolson, Tarrytown, N. Y. App. filed June 6, 1914. Input electrode and cathode are entwined.

1,169,426. PLUG SWITCH; F. J. Ravlin and J. Lofgren, Chicago, Ill. App. filed Dec. 3, 1914. For three-phase, three-wire systems.

1,169,428. MEANS FOR REMOVING STATIC ELECTRICITY FROM MATERIALS; G. D. Rogers, Lakewood, Ohio. App. filed Jan. 14, 1915. Designed particularly for printing presses.

1,169,431. ELECTRICAL CONNECTOR; G. A. Schaefer, Chicago, Ill. App. filed April 23, 1914. Has yielding jaws to receive a switch.

1,169,450. CONTROLLING MECHANISM FOR ELECTRIC-MOTOR VEHICLES; S. S. Amdursky, Rochester, N. Y. App. filed Dec. 17, 1914. Prevents waste of current.



1,169,518—Electric Starter for Automobile Engines

1,169,459. TRAIN-SERVICE COUPLING; A. J. Campbell, Marion, Iowa. App. filed Jan. 25, 1915. Combined air brake and electrical coupling.

1,169,465. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed Dec. 29, 1910. Battery charging.

1,169,466. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed April 13, 1911. Automatic governing of generator.

1,169,475. MAGNETIC APPARATUS; G. P. Finnigan, Wilton-on-James, near Richmond, Va. App. filed March 26, 1914. Neutralizing or eliminating residual magnetism.

1,169,484. PROCESS AND APPARATUS FOR MAKING BRAZED JOINTS; F. W. Heuser, Gross-Lichterfelde, near Berlin, Germany. App. filed Feb. 6, 1914. For making rail joints.

1,169,497. DEVICE FOR FASTENING ELECTRIC-LIGHT BULBS TO A SOCKET; C. E. Kohlmann, Fresno, Cal. App. filed May 20, 1915. Attachable to ordinary lamp socket.

1,169,508. DEMAND APPARATUS; W. E. Porter, Lynn, Mass. App. filed March 18, 1913. Records character and magnitude of demand made on generating station.

1,169,518. ELECTRIC STARTER FOR AUTOMOBILE ENGINES; A. W. Smith, Washington, D. C. App. filed Nov. 20, 1915. In magnetic relation to flywheel.

1,169,532. ELECTRIC ATTACHMENT DEVICE; H. W. Denhard. San Francisco, Cal. App. filed Nov. 15, 1911. Particularly for electric-heating devices.

1,169,537. COMBINED ALTERNATING AND DIRECT CURRENT DISTRIBUTING SYSTEM; J. H. Gugler and G. W. Colles, Milwaukee, Wis. App. filed Feb. 8, 1911. Direct current automatically turned on lighting system when alternating current is discontinued.

1,169,545. INSULATOR BRACKET; F. P. Kobert, Milldale, Conn. App. filed Jan. 21, 1915. For attachment to a wall.

1,169,549. ELECTROTHERMOSTAT; T. Lidberg, Chicago, Ill. App. filed May 19, 1914. Particularly sensitive for incubators and the like.

1,169,552. OPERATING CIRCUIT AND SWITCH ARRANGEMENT FOR CAR MOTORS; J. S. McWhirter, New York, N. Y. App. filed Oct. 9, 1913. Special controller features.

1,169,611. THERMO-ELECTRIC COUPLE; W. H. Bristol, Waterbury, Conn. App. filed April 28, 1915. Consists of elements containing nickel-aluminum and nickel-chromium.

1,169,612. MAGNETO MACHINE; W. Brown, Racine, Wis. App. filed May 3, 1915. Has a spring-returned rotor.

1,169,613. ATTACHMENT-PLUG RECEPTACLE; F. V. Burton, Bridgeport, Conn. App. filed June 23, 1915. Arranged to receive jack blades of plugs of different construction.

1,169,676. FREQUENCY CONVERTER; P. F. Pichon and A. Meissner, Berlin, Germany. App. filed July 19, 1913. Iron core highly saturated magnetically.

1,169,692. ALARM CONTROLLER FOR SPRINKLER SYSTEM; N. H. Suren Needham, Mass. App. filed April 6, 1914. Obviates false alarms through "water hammer," etc.

1,169,703. PROCESS FOR THE CATHODIC PRODUCTION OF SOLID PEROXIDE COMPOUNDS; W. Weber, Dusseldorf, Germany. App. filed March 1, 1915. Electrolyzes watery electrolyte containing oxygen gas.

1,169,713. ELECTRIC SELECTIVE INSTRUMENT; T. Bodde, Westfield, N. J. App. filed Dec. 30, 1907. Specially designed for signal systems.

1,169,723. PROTECTIVE DEVICE FOR THREE-PHASE MOTORS; N. Joleen, Chicago, Ill. App. filed May 12, 1913. Applicable to motor-generators for charging batteries.

1,169,736. TELEPHONE-EXCHANGE SYSTEM; F. Schoenwolf, Chicago, Ill. App. filed Dec. 16, 1908. Two-wire automatic or semi-automatic.

1,169,744. SPARK INTENSIFIER FOR SPARK PLUGS; A. F. Gillet, Omaha, Neb. App. filed Dec. 17, 1914. Spark gap attached to spark plug.

1,169,754. AUTOMATIC TELEPHONE SYSTEM; F. Schoenwolf, Chicago, Ill. App. filed Aug. 3, 1908. Selective switch construction.

14,051 (re-issue). ELECTRIC BATTERY; F. S. B. de Mello, Rio de Janeiro, Brazil. App. filed Nov. 20, 1915; original No. 1,148,152, dated July 27, 1915. Protosulphide of copper depolarized.